GUIDE TO USING 1995

MARYLAND BIOLOGICAL

STREAM SURVEY DATA

Prepared for

Maryland Department of Natural Resources
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FOREWORD

Versar, Inc., prepared this report, *Guide to Using 1995 Maryland Biological Stream Survey Data*, in support of the Maryland Department of Natural Resources' Maryland Biological Stream Survey (MBSS) under the direction of Dr. Ronald Klauda and Mr. Paul Kazyak of the Monitoring and Non-Tidal Assessment Division. This report was prepared as part of Maryland's Power Plant Research Program under the direction of Dr. John Sherwell (contract no. PR-91-047-001 to Versar, Inc.). The report contains a description of the content of 1995 Maryland Biological Stream Survey (MBSS) data sets and formats for individual data elements in those data sets. The purpose of this report is to facilitate use of the 1995 MBSS data by those interested in these data for ecological assessments.

The MBSS is a cooperative effort among several agencies and consultants, including Maryland Department of Natural Resources, Maryland Department of the Environment, University of Maryland Appalachian Environmental Laboratory, University of Maryland Agricultural Experiment Station, Coastal Environmental Services, and Versar, Inc. The authors wish to acknowledge the contributions of those who assisted in the collection, entry, and compilation of the 1995 MBSS data. We particularly thank Scott Stranko, Suzanne Kelly, and Tony Prochaska of DNR for their hard work in data entry and management. We also thank Jon Volstad, Don Strebel, Kathy Bowles, and Gail Lucas of Versar for their contributions to this report.

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1 OVERVIEW

1.1 THE MARYLAND BIOLOGICAL STREAM SURVEY

The Maryland Biological Stream Survey (MBSS) is a comprehensive sampling program to assess the status of biological resources in Maryland's non-tidal streams, quantify the extent to which acidic deposition has affected or may be affecting critical biological resources in the state, and establish a benchmark for long-term monitoring of trends in these resources. The survey is intended to help environmental decision-makers. MBSS provides abundance and biomass estimates of fish, maps the geographic distribution of biological resources, establishes priorities for environmental issues of concern in Maryland's streams and rivers, and helps to identify regions that most require protection or mitigation.

Three characteristics of the MBSS differentiate it from most previous stream monitoring surveys in the state. First, sampling in the MBSS is probability-based, allowing the quantification of uncertainty in estimates of variables such as densities of particular species of fish or the number of miles of stream with degraded habitat. The probability-based sampling design also permits estimation of standard error, so that estimates of status can be made with quantifiable confidence. Second, MBSS monitoring and assessments focus on biological indicators of response to stress; metrics for characterizing pollutant stress and habitat condition are measured simultaneously to provide a context for interpreting biological response. Third, the scale of MBSS monitoring is basinwide and statewide, rather than local.

The MBSS uses a special probability-based survey design called lattice sampling to ensure that all eighteen major drainage basins in Maryland are sampled over a three year period. The lattice design effectively stratifies by year and basins and restricts the sampling each year to about one-third of the state's 18 basins. This restriction is employed to optimize the efficiency of the field effort by minimizing the travel time between sampling locations. Approximately 300 stream segments of fixed length are sampled each year, with biological, chemical, and physical parameters measured at each segment using standardized methods. Biological measurements include abundance, size, and health of fish, composition of benthic invertebrate communities, and presence of herpetofauna, aquatic macrophytes, and mussels. Chemical measurements include pH, acid-neutralizing capacity (ANC), sulfate, nitrate, conductivity, dissolved oxygen and dissolved organic carbon (DOC). Physical habitat measurements include flow, stream gradient, maximum depth, wetted width, temperature, embeddedness, instream habitat, pool and riffle quality, bank stability, shading, and riparian vegetation. Other qualitative habitat parameters include: aesthetic value, remoteness, and land use, based on the surrounding area immediately visible from the segment.

The MBSS is being implemented in several stages. The first stage was a pilot program conducted in 1993 in four watersheds of the Appalachian Plateau and Coastal Plain physiographic regions (Vølstad et al. 1995). The Pilot Study was conducted to

- evaluate the effectiveness and adequacy of logistical protocols, including the process of selecting sampling segments, obtaining landowners' permission for access to sampling segments, field sampling, and training the field crews;

- evaluate the effectiveness and adequacy of the statistical design for answering questions of interest; and

- refine estimates of the time requirements and cost to implement a full-scale MBSS.

The Pilot Study was followed by a statewide Demonstration Project in 1994 that incorporated changes in sampling design and logistics that resulted from the Pilot Study. The primary goals of the Demonstration Project were to further refine logistics at a larger spatial scale and to gather the data needed to refine the questions the program could successfully address with available resources. The Demonstration Project also served as the first phase of a program to sample all basins in the state. The program used information gained from the Demonstration Project to further refine the study prior to the implementation of the 1995 MBSS.

The MBSS Demonstration Project conducted in 1994 was the first year of statewide sampling. It involved sampling 279 stream segments in 7 of the state's 18 basins: the Youghiogheny, Potomac-Washington Metro, Patuxent, West Chesapeake, Susquehanna, Choptank, and Pocomoke. Results of the 1994 Demonstration Project are reported in Volstad et al. (1996). Data for 1994 are available, along with the *Guide to Using 1994 Maryland Biological Stream Survey Data* (Roth et al. 1997a).

Statewide sampling continued with the 1995 Implementation of the MBSS, during which 284 stream segments were sampled in 6 of the state's 18 basins: the Youghiogheny, Upper Potomac, Lower Potomac, Patapsco, Chester, and Nanticoke/Wicomico. A number of alterations to the 1994 study design were implemented in 1995, as explained in Section 2.1. Most notably, the method for site selection was modified. In addition, minor changes made in the collection and recording of data have been incorporated into this Guide. Details of the study design and analyses of the 1995 results are included in the MBSS report for the 1995 sampling year (Roth et al. 1997b). The 1995 MBSS data were used for preliminary development of biological indices to quantify site-specific biological conditions. These data were also used in preliminary analyses of relationships among physical, chemical, and biological parameters, although complete analyses will be conducted when statewide data are available.

1.2 THE DATA USERS GUIDE

The *Guide to Using 1995 Maryland Biological Stream Survey Data* and its accompanying data sets include data from the 1995 MBSS sampling year. Data sets are

available in DOS dBase III format on a 3½ inch diskette. This guide provides written documentation and explanation of the information in the 1995 database. Chapter 2 contains background information on the MBSS, including an explanation of the 1995 sampling design and an overview of laboratory and fields methods. More detailed information on methods may be found in the MBSS sampling manual (Kazyak 1995). Chapter 3 describes the contents of each data set. Variables listed in the each of the 13 data sets are defined and additional information provided to assist users in interpreting and analyzing MBSS data. Chapter 4 gives some guidelines for data analysis. Sample data field data sheets are found in Appendix A. Appendix B lists differences between the 1994 and 1995 data sets.

1.3 CONTACT FOR DATA AND INFORMATION

MBSS data sets, program reports, and other information are available upon request to:

Maryland Biological Stream Survey
Monitoring and Non-Tidal Assessment Division
Maryland Department of Natural Resources
Tawes State Office Building, C-2
580 Taylor Avenue
Annapolis, Maryland 21401

2 GENERAL DESCRIPTION

2.1 1995 MBSS STUDY DESIGN

The 1995 Implementation of MBSS was part of a multi-year sampling program for assessing the status of biological resources in non-tidal streams of Maryland, and how they are affected by acidic deposition and other factors. The MBSS study area comprises 18 distinct drainage basins (Figure 2-1). Because it would have been prohibitively costly to visit sites in all basins in a single year, lattice sampling was used to schedule sampling of basins over a three-year period. Lattice sampling, also known as multistratification, is a cost-effective means of allocating effort across time in a large geographic area (see Cochran 1977, Jessen 1978). A table, or lattice, was formed by arranging the basins in 18 rows, and the years in 3 columns. Lattice sampling was the method used for selecting cells from this 18x3 table so that all cells would be sampled over a three-year period (Table 2-1).

Table 2-1. Basins in the MBSS study area, and the year they are scheduled for sampling.

Region	Basin	94	95	96
West	Youghiogheny	X	X	
	North Branch Potomac			X
	Upper Potomac		X	
	Middle Potomac			X
	Potomac Washington Metro	X		
Central	Patuxent	X		
	West Chesapeake	X		
	Lower Potomac		X	
	Patapsco		X	X
	Bush			X
	Gunpowder			X
East	Susquehanna	X		
	Elk			X
	Chester		X	
	Choptank	X		X
	Nanticoke/Wicomico		X	
	Pocomoke	X		

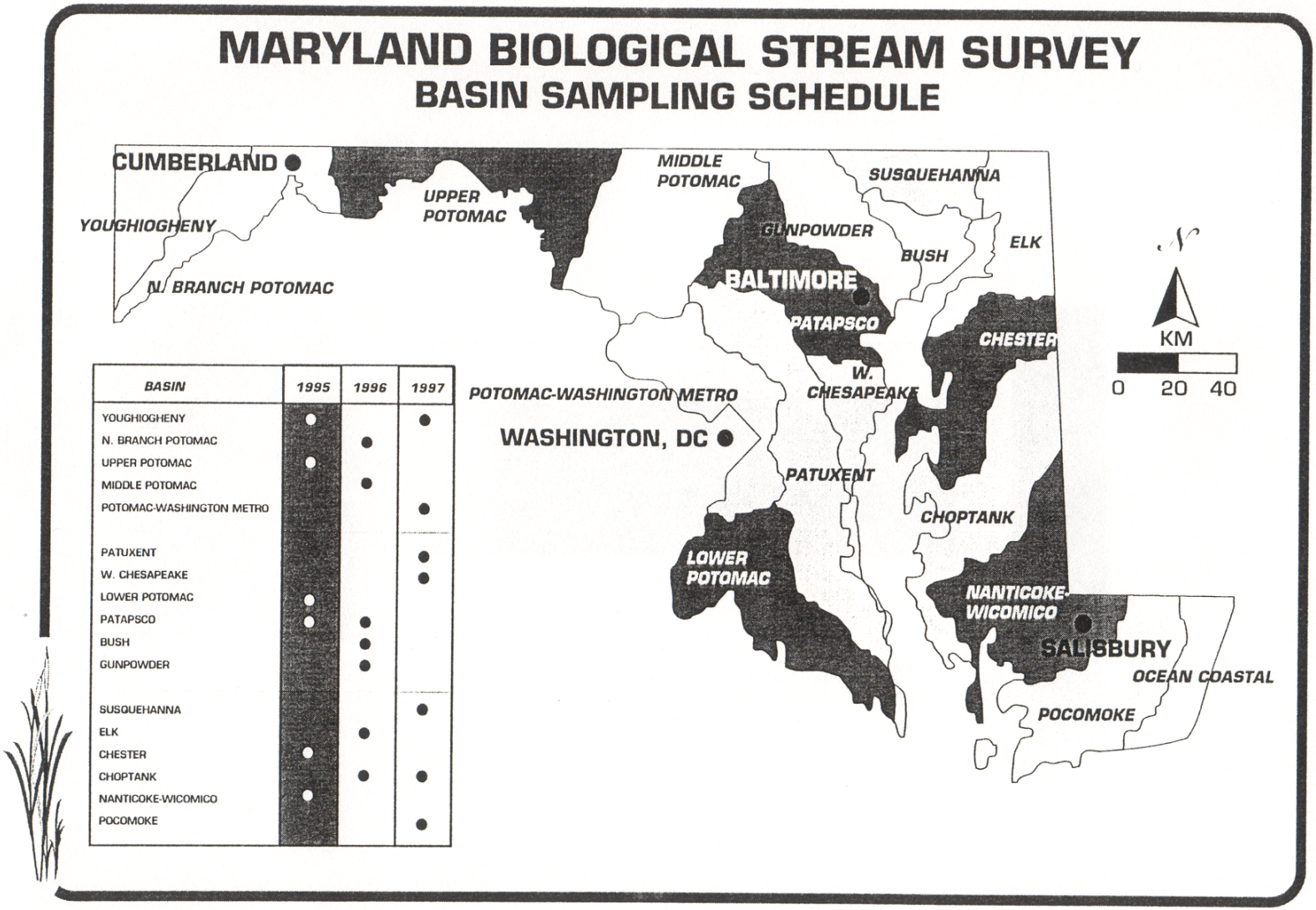

Figure 2-1. Sampling schedule for MBSS basins

The MBSS study area was divided into three geographic regions with five to seven basins each: (1) western, (2) central, and (3) eastern. This geographic stratification facilitated the effective use of three sampling crews from the different regions. Two basins were randomly selected (without replacement) from each region for sampling each year. One randomly selected basin in each region is to be visited twice, in order to quantify between-year variability in the response variables. This controlled selection of cells from the lattice allows estimation of average condition for all cells; i.e., the average condition for all basins over a three-year period.

The sampling frame for the three year study was constructed by overlaying basin boundaries on a map of all blue line stream reaches in the study area as digitized on a U.S. Geological Survey 1:250,000 scale map. The Strahler convention (Strahler 1957) was used for ranking stream reaches by order; first order reaches, for example, are the most upstream reaches in the branching stream system. Sampling was restricted to non-tidal, third order and smaller stream reaches, excluding impoundments that were non-wadable or that substantially altered the riverine nature of the reach (Kazyak 1994). Stream reaches were further divided into non-overlapping, 75-meter segments; these segments were the elementary sampling units for which biological, water chemistry, and physical habitat data were collected.

The MBSS is restricted to first, second, and third-order streams in Maryland, as determined from the 1:250,000 scale base map. It is important that the stream systems to be included in the survey be precisely described in terms of the extent, location, and order of each type of stream. Only by reference to these "total stream miles" (Table 2-2) can estimates of the percentage of the resource with certain attributes be converted to the total amount of the resource.

Table 2-2. The number of stream miles by stream order for basins sampled in the 1995 Maryland Biological Stream Survey

Basin	Order 1	Order 2	Order 3	Combined
Youghiogheny	244.0	87.2	43.1	374.3
Upper Potomac	463.9	161.9	42.8	668.6
Lower Potomac	502.6	100.0	48.4	651.0
Patapsco	422.6	134.1	60.0	616.7
Chester	216.6	64.2	10.3	291.1
Nanticoke/Wicomico	192.8	28.7	5.5	227.0
TOTAL	2042.5	576.1	210.1	2828.7

The 1995 MBSS study design was based on stratified random sampling of segments within each basin; each basin was stratified by stream order (orders 1-3) (Figure 2-2). Random sampling of segments within each basin and stream order allows the estimation of unbiased summary statistics (e.g., means and proportions, and their respective variances) for the entire basin, or for subpopulations of special interest (see Roth et al. 1997b for details). Approximately equal numbers of stream segments were sampled from each stream order across the six basins. For each basin, the number of samples was approximately proportional to the number of stream miles in a basin.

To achieve the target number of samples per stream order within each basin, a given number of segments were randomly selected from each basin and ranked in order of selection. Extra segments were selected as contingency against loss of sampling sites from restricted access to selected streams or from streams that were dry. Permissions were obtained to access privately owned land adjacent to or near each stream segment. The procedures for obtaining permissions are described in Chaillou (1995). In all, 284 stream segments were successfully sampled in spring 1995; of those, 270 were sampled in summer (Table 2-3).

Table 2-3. Number of stream segments sampled in 1995 MBSS

Basin	Order 1	Order 2	Order 3	Combined
SPRING				
Youghiogheny	13	14	14	41
Upper Potomac	23	31	15	69
Lower Potomac	20	19	15	54
Patapsco	18	23	20	61
Chester	15	12	15	42
Nanticoke/Wicomico	11	6	0	17
TOTAL	100	105	79	284
SUMMER				
Youghiogheny	11	13	14	38
Upper Potomac	19	31	15	65
Lower Potomac	19	16	15	50
Patapsco	18	23	20	61
Chester	13	12	14	39
Nanticoke/Wicomico	11	6	0	17
TOTAL	91	101	78	270

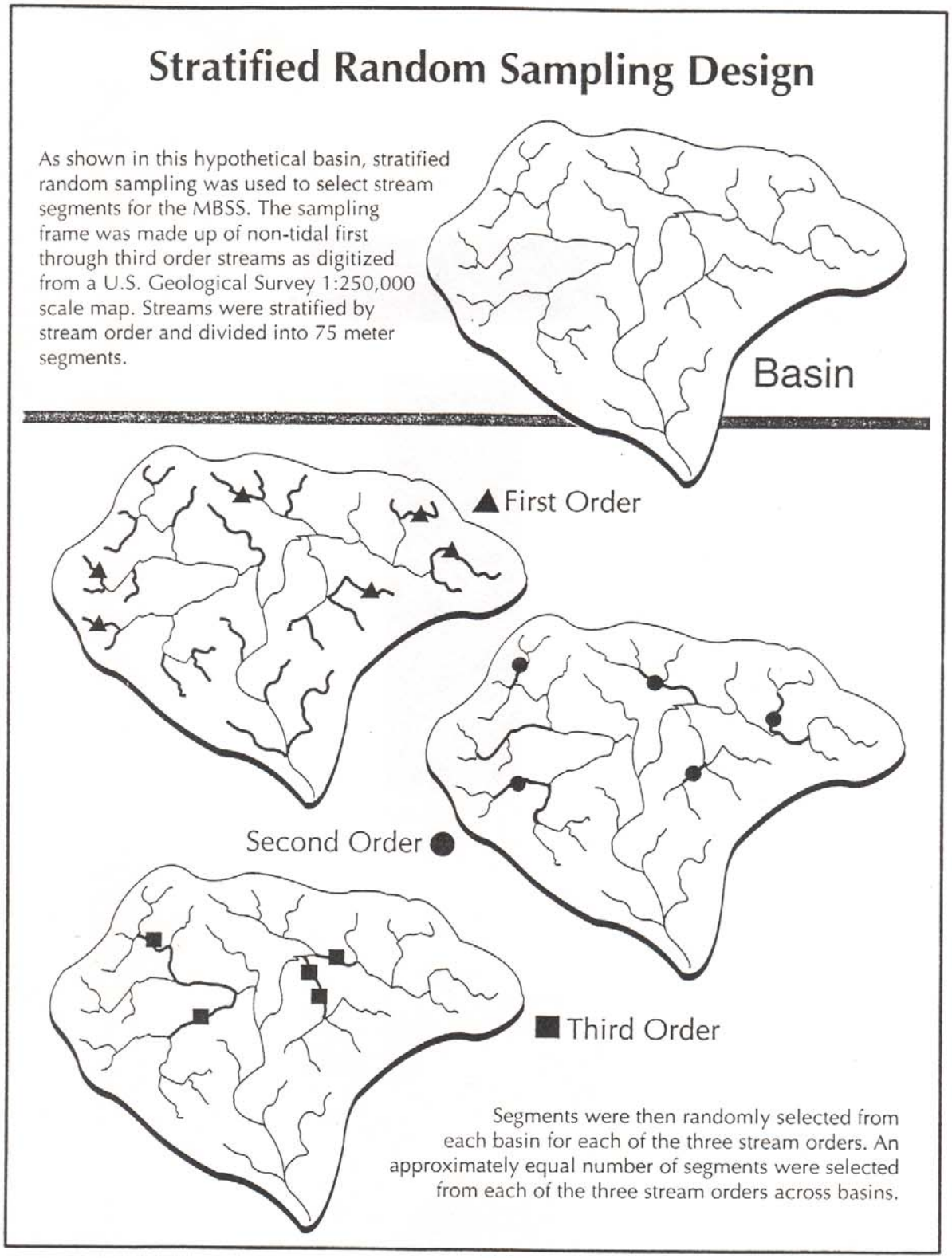

Figure 2-2. MBSS stratified random sampling design

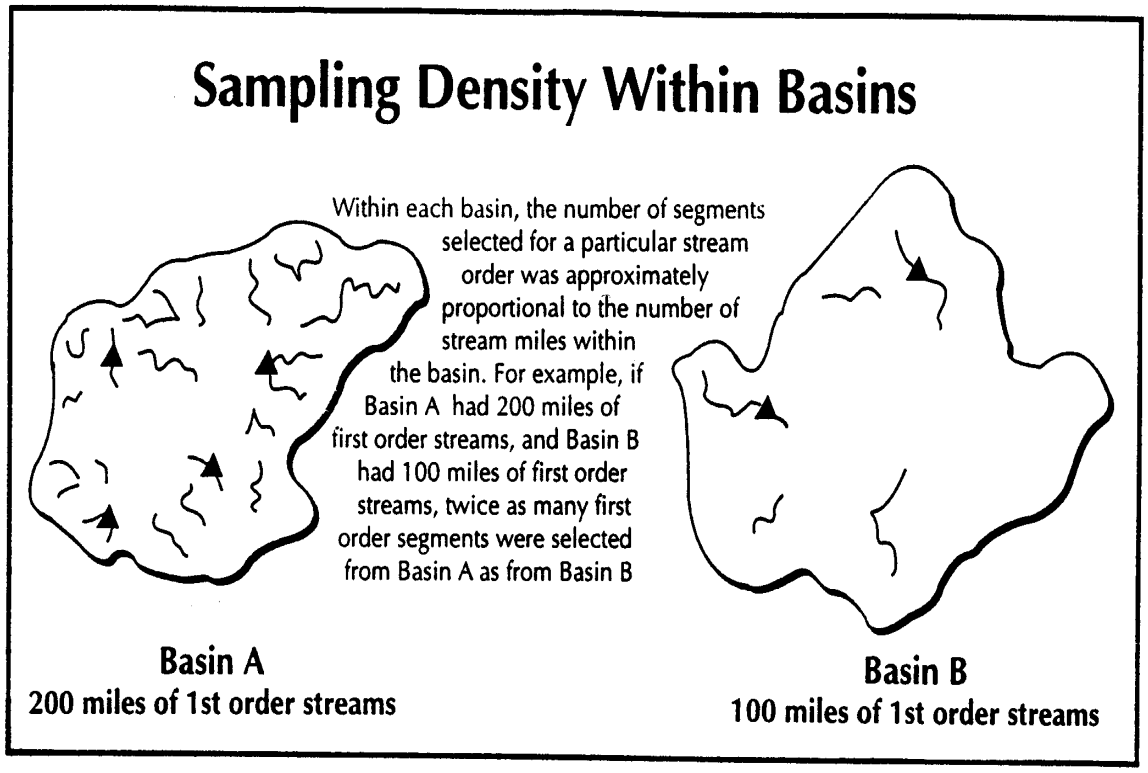

Figure. 2-2. Continued

Between 1994 and 1995 sampling, the MBSS study design was changed substantially. Data users should note this key difference in sample design if data from both 1994 and 1995 are to be analyzed. The statewide random stratified sampling employed in 1995 was not used in 1994. Instead, 1994 sampling was based on a multistage sampling design, with sampling units at three stages: watersheds, stream reaches, and 75-meter stream segments. Three types of watershed units were included, based on whether a reach flowing into a downstream fourth (or higher) order stream was itself a first, second, or third order stream. Reaches within a watershed were substratified into first, second, and third order reaches. Two segments were selected from each reach. For more information on the 1994 data and study design, see Volstad et al. (1996) and Roth et al. (1997a).

2.2 FIELD AND LABORATORY METHODS

Sampling procedures for the 1995 Implementation Project followed procedures specified in the 1995 MBSS Sampling Manual (Kazyak 1995). Procedures were similar to those of the 1994 Demonstration Project (Kazyak 1994), with only slight modifications. A summary of the parameters measured and the methods used to conduct the sampling follows. Example data sheets for the spring and summer index periods are found in Appendix A.

2.2.1 Spring and Summer Index Periods

Two hundred eighty-four stream segments were sampled in the spring of 1995 (Table 2-3). Benthic macroinvertebrate and water quality sampling was conducted in spring, when the benthos are thought to be reliable indicators of environmental stress (Plafkin et al. 1989). Fish, herpetofauna, macrophyte, and mussel sampling, along with physical habitat evaluations, were conducted at 270 segments during the low flow period in summer. The effects of spawning migration on fish communities is minimal during summer, and low flow is advantageous for electrofishing. Because low flow conditions in summer may be a primary factor limiting the abundance and distribution of fish populations, habitat assessments were performed during the summer. The sample size in summer is lower than in spring (284 sites) because some streams were ephemeral (dry in summer) or otherwise unsampleable.

To reduce temporal variability, sampling during spring and summer was conducted within specific short time intervals, referred to as index periods (Janicki et al. 1993). The study provided a synoptic assessment of the current status of stream biota in the six basins sampled, along with water quality and physical habitat conditions. The spring index period was selected as the time period between about March 1 and May 1, and the summer index period was between about June 1 and September 30 (Kazyak 1994).

2.2.2 Water Chemistry

During the spring index period, water samples were collected at each site for analysis of pH, acid neutralizing capacity (ANC), conductivity, sulfate, nitrate, and dissolved organic

carbon (DOC). These variables describe basic water quality conditions with an emphasis on changes related to acidic deposition.

Grab samples were collected in one-liter bottles for analysis of all analytes except pH. Water samples for pH were collected with syringes, which allowed purging of air bubbles to minimize changes in carbon dioxide content (EPA 1987). Samples were stored on wet ice and shipped on wet ice to the analytical laboratory within 48 hours.

Chemical analysis of water samples followed standard methods described in EPA's Handbook of Methods for Acid Deposition Studies (EPA 1987). These methods are summarized in Table 2-4. EPA protocols were followed except ANC sample volume was reduced to 40 ml to ease sample handling. Routine daily quality control (QC) checks included processing duplicate, blank, and calibration samples according to EPA guidelines for each analyte. Routine QC checks helped to identify and correct errors in sampling routines or instrumentation at the earliest possible stage.

Table 2-4. Analytical methods used for water chemistry samples collected during the spring index period. See EPA (1987) for details.

Analyte (units)	Method	Instrument	Detection Limit	Holding Time (days)
pH (standard units)	EPA Sec. 19.0	Closed system using Orion 611 pH meter equipped with Orion 08104 Ross combination electrode and Hellman chamber	0.01	7
Specific Conductance (μmho/cm)	EPA 120.1	YI 32 equipped with 3403 conductivity cell (1.0 cm/sec cell constant)	NA	14
Acid Neutralizing Capacity (μeq/l)	EPA Sec. 5.0 modified	Titration (modified Grinned analysis) using Orion 611 pH meter	NA	14
Dissolved Organic Carbon (mg/l)	EPA 415.1	Doorman DC-80 carbon analyzer	1.0	14
Sulfate (mg/l)	EPA 300.0	Danaus 2001i ion chromatography (with upgrade)	0.206	14
Nitrate (mg/l)	EPA 300.0	Danaus 2001i ion chromatography (with upgrade)	0.013	14

NA = Not Applicable

During the summer index period, *in situ* measurements of dissolved oxygen (DO), pH, temperature, and conductivity were collected at each site to further characterize existing water quality conditions that might influence biological communities. Measurements were made at an undisturbed section of the segment, usually in the middle of the stream channel, using electrode probes. Instruments were calibrated daily and calibration logbooks were maintained to document instrument performance.

2.2.3 Benthic Macroinvertebrates

Benthic macroinvertebrates were collected to provide a qualitative description of the community composition at each sampling site (Janicki et al. 1993). Sampling was conducted during the spring index period. Benthic community data will be used to calculate biological metrics, such as those described in EPA's Rapid Bioassessment Protocols (Plafkin et al. 1989), and to develop a benthic indicator for Maryland streams.

At each segment, a "D" net was used to collect organisms from habitats likely to support the greatest taxonomic diversity. A riffle area was preferred, but other habitats were also sampled using a variety of techniques including kicking, jabbing, and gently rubbing hard surfaces by hand to dislodge organisms. Other habitat types, if available, included rootwads, woody debris, leaf packs, macrophytes, and undercut banks. Each jab covered one square foot, and a total of approximately 2.0 m^2 (20 square feet) of combined substrates was sampled and preserved in 70% ethanol. In the laboratory, the preserved sample was transferred to a gridded pan and organisms were picked from randomly selected grid cells until the cell that contained the 100th individual (if possible) was completely picked. Some samples had less than 100 individuals. The benthic macroinvertebrates were identified in the laboratory to family level when possible.

2.2.4 Fish

Fish were sampled during the summer index period using double-pass electrofishing of the 75-meter stream segments. Block nets were placed at each end of the segment and direct current backpack electrofishing units were used to sample the entire segment. An attempt was made to thoroughly fish each segment, sampling all available cover and habitat structures throughout the segment. A consistent effort was applied over the two passes. This sampling approach allows calculation of several metrics useful in calculating a biological index and in producing estimates of fish species abundance.

In general, a single electrofishing unit was used when the segment width was less than ten meters; two or more units were used for larger widths. Captured fish were identified to species, if possible, and counted. Any individuals which could not be identified to species were retained for laboratory confirmation. For each pass, up to 50 individuals of each gamefish species (defined as trout, bass, walleye, pike, chain pickerel, and striped bass) were

measured for total length. Up to 100 fish of each species (from both passes) were examined for visible external pathology or anomalies. For each pass, all non-game species were weighed together for an aggregate biomass measurement; gamefish were also weighed in aggregate to the nearest 10 g.

After processing of the fish collection was completed in the field, voucher specimens were retained for each species not previously collected in the drainage basin, and the remaining fish were released. All voucher specimens and fish retained for positive identification in the laboratory were examined and verified by the MBSS Quality Assurance Officer or ichthyologists at Frostburg State University, Frostburg, Maryland, or the Smithsonian Institution, Washington DC.

2.2.5 Herpetofauna

At each sample segment, amphibians and reptiles were identified and the presence of observed species was recorded during the summer index period. A search of the riparian area was conducted within 5 meters of the stream on both sides of the 75-meter segment. Any herpetofauna collected during the electrofishing of the stream segment were also included in the species list. Individuals were identified to species when possible. Voucher specimens and individuals not positively identifiable in the field were retained for examination and verification in the laboratory.

2.2.6 Aquatic Vegetation

During the summer index period, submerged aquatic vegetation (SAV) was sampled qualitatively by examining each 75-meter stream segment for the presence of aquatic macrophytes. Plants were identified to species and their presence recorded for each site. Emergent vegetation was also recorded when encountered. Species not positively identifiable in the field were retained for examination and verification in the laboratory. Due to the difficulty in long-term preservation, no permanent vouchers of SAV were retained.

2.2.7 Mussels

During the summer index period, freshwater mussels were sampled qualitatively by examining each 75-meter stream segment for the presence of mussels. Mussels were identified to species and their presence recorded. Species not positively identifiable in the field were retained for examination and verification in the laboratory.

2.2.8 Physical Habitat

Habitat assessments were conducted at all stream segments as a means of assessing the importance of physical habitat to the biological integrity and fishability of freshwater streams in

Maryland. Procedures for habitat assessments (Kazyak 1995) were derived from two currently used methodologies: EPA's Rapid Bioassessment Protocols (RBPs) (Plafkin et al. 1989), as modified by Barbour and Stribling (1991), and the Ohio EPA's Qualitative Habitat Evaluation Index (QHEI) (Ohio EPA 1987, Rankin 1989). Guidelines for qualitative habitat assessment scoring are listed in Table 2-5. A number of characteristics (instream habitat, epifaunal substrate, velocity/depth diversity, pool/glide/eddy quality, riffle quality, channel alteration, bank stability, embeddedness, channel flow status, and shading) were assessed qualitatively, based on visual observations within each 75-meter sample segment. Riparian vegetation width was estimated, up to 50 m from the stream. Additional observations of the surrounding area were used to assign ratings for aesthetic value (based on visible signs of human refuse at a site), and remoteness (based on distance from the nearest road, accessibility, and evidence of human activity). Also recorded were the presence or absence of various stream features including substrate types, various morphological characteristics, beaver ponds, point sources, stream channelization, and the quantity of rootwads and other woody debris. Local land uses visible from the stream segment and riparian vegetation type were categorized.

Several additional physical characteristics were measured quantitatively to further characterize the habitat for each segment (see Kazyak 1995 for details). Quantitative measurements of the segment included maximum depth, stream gradient, wetted width, straight-line segment length, and overbank flood height. A velocity/depth profile was measured or other data collected to enable calculation of discharge.

2.3 QA/QC FOR FIELD SAMPLING

A Quality Assurance Officer (QAO) experienced in all aspects of the survey was appointed to administer the quality assurance program. Specific quality assurance activities administered by the QAO included preparation of a field manual of standard sampling protocols, designing standard forms for recording field data, conducting field crew training and proficiency examinations, conducting field and laboratory audits, making independent habitat assessments, and taxa identification.

To ensure consistent implementation of sampling procedures and a high level of technical competency, experienced field biologists were assigned to each crew and all field personnel completed program training before participating in the 1995 MBSS. Training topics included MBSS program orientation, stream segment location using global positioning system (GPS) equipment, sampling protocols, operation and maintenance of sampling equipment, data transcription, quality assurance/quality control, and safety. The spring field crew received additional training in sampling protocols for water quality and benthic macroinvertebrates. The summer field crews received additional training in habitat assessment methods, fish taxonomy, and *in situ* water chemistry assessment.

Training included classroom, laboratory, and field activities. Instructors emphasized the objectives of MBSS and the importance of strict adherence to the sampling protocols. The

Table 2-5. Guidelines for qualitative habitat assessment (Kazyak 1995)

MBSS Habitat Assessment Guidance Sheet				
Habitat Parameter	**Optimal 16-20**	**Sub-Optimal 11-15**	**Marginal 6-10**	**Poor 0-5**
1. Instream Habitat[a]	Greater than 50% mix of a variety of cobble, boulder, submerged logs, undercut banks, snags, rootwads, aquatic plants, or other stable habitat	30-50% mix of stable habitat. Adequate habitat	10-30% mix of stable habitat. Habitat availability less than desirable	Less than 10% stable habitat. Lack of habitat is obvious
2. Epifaunal Substrate[b]	Preferred substrate abundant, stable, and at full colonization potential (riffles well developed and dominated by cobble; and/or woody debris prevalent, not new, and not transient)	Abund. of cobble with gravel &/or boulders common; or woody debris, aquatic veg., under-cut banks, or other productive surfaces common but not prevalent /suited for full colonization	Large boulders and/or bedrock prevalent; cobble, woody debris, or other preferred surfaces uncommon	Stable substrate lacking; or particles are over 75% surrounded by fine sediment or flocculent material
3. Velocity/Depth Diversity[c]	Slow (<0.3 m/s), deep (>0.5 m); slow, shallow (<0.5 m); fast (>0.3 m/s), deep; fast, shallow habitats all present	Only 3 of the 4 habitat categories present	Only 2 of the 4 habitat categories present	Dominated by 1 velocity/depth category (usually pools)
4. Pool/Glide/Eddy Quality[d]	>50% pool/glide/eddy habitat; both deep (>.5 m)/shallows (<.2 m) present; complex cover/&/or depth >1.5 m	10-50% pool/glide/eddy habitat, with deep (>0.5 m) areas present; or >50% slow water with little cover	<10% pool/glide/eddy habitat, with shallows (<0.2 m) prevalent; slow water areas with little cover	Pool/glide/eddy habitat minimal, with max depth <0.2 m, or absent completely
5. Riffle Quality[e]	Riffle/run depth generally >10 cm, with maximum depth greater than 50 cm (maximum score); substrate stable (e.g. cobble, boulder) & variety of current velocities	Riffle/run depth generally 5-10 cm, variety of current velocities	Riffle/run depth generally 1-5 cm; primarily a single current velocity	Riffle/run depth < 1 cm; or riffle/run substrates concreted
6. Channel Alteration[f]	Little or no enlargement of islands or point bars; no evidence of channel straightening or dredging; 0-10% of stream banks artificially armored or lined	Bar formation, mostly from coarse gravel; and/or 10-40% of stream banks artificially armored or obviously channelized	Recent but moderate deposition of gravel and coarse sand on bars; and/or embankments on both banks; and/or 40-80% of banks artificially armored; or channel lined in concrete	Heavy deposits of fine material, extensive bar development; OR recent channelization or dredging evident; or over 80% of banks artificially armored
7. Bank Stability[g]	Upper bank stable, 0-10% of banks with erosional scars and little potential for future problems	Moderately stable. 10-30% of banks with erosional scars, mostly healed over. Slight potential in extreme floods	Moderately unstable. 30-60% of banks with erosional scars and high erosion potential during extreme high flow	Unstable. Many eroded areas. "Raw" areas frequent along straight sections and bends. Side slopes >60° common
8. Embeddedness[h]	Percentage that gravel, cobble, and boulder particles are surrounded by line sediment or flocculent material.			
9. Channel Flow Status[i]	Percentage that water fills available channel			
10. Shading[j]	Percentage of segment that is shaded (duration is considered in scoring). 0% = fully exposed to sunlight all day in summer; 100% = fully and densely shaded all day in summer			
11. Riparian Buffer[k]	Minimum width of vegetated buffer in meters; 50 meters maximum; see back of Habitat Assessment Data Sheet for buffer type and land cover immediately adjacent to buffer			

Habitat Parameter	Optimal (16-20)	Sub-Optimal (11-15)	Marginal (6-10)	Poor (0-5)
12. Aesthetic Rating[l]	Little or no evidence of human refuse present; vegetation visible from stream essentially in a natural state	Human refuse present in minor amounts; and/or channelization present but not readily apparent; and/or minor disturbance of riparian vegetation	Refuse present in moderate amounts; and/or channel-ization readily apparent; and/or moderate disturbance of riparian vegetation	Human refuse abundant and un-sightly: and/or extensive unnatural channelization; and/or nearly complete lack of vegetation
13. Remoteness[m]	Stream segment more than 1/4 mile from nearest road; access difficult and little or no evidence of human activity	Stream segment within 1/4 of but not immediately accessible to roadside access by trail; site with moderately wild character	Stream within 1/4 mile of roadside and accessible by trail; anthropogenic activities readily evident	Segment immediately adjacent to roadside access; visual , olfactory, and/or auditory displeasure experienced

a) **Instream Habitat** Rated based on perceived value of habitat to the fish community. Within each category, higher scores should be assigned to sites with a variety of habitat types and particle sizes. In addition, higher scores should be assigned to sites with a high degree of hypsographic complexity (uneven bottom). In streams where ferric hydroxide is present, instream habitat scores are not lowered unless the precipitate has changed the gross physical nature of the substrate. In streams where substrate types are favorable but flows are so low that fish are essentially precluded from using the habitat, low scores are assigned. If none of the habitat within a segment is useable by fish, a score of zero is assigned.

b) **Epifaunal Substrate** Rated based on the amount and variety of hard, stable substrates usable by benthic macroinvertebrates. Because they inhibit colonization, flocculent materials or fine sediments surrounding otherwise good substrates are assigned low scores. Scores are also reduced when substrates are less stable.

c) **Velocity/Depth Diversity** Rated based on the variety of velocity/depth regimes present at a site (slow-shallow, slow-deep, fast-shallow, and fast-deep). As with embeddedness, this metric may result in lower scores in low-gradient streams but will provide a statewide information on the physical habitat found in Maryland streams.

d) **Pool/Glide/Eddy Quality** Rated based on the variety and spatial complexity of slow- or still-water habitat within the sample segment. It should be noted that even in high-gradient segments, functionally important slow-water habitat may exist in the form of larger eddies. Within a category, higher scores are assigned to segments which have undercut banks, woody debris or other types of cover for fish.

e) **Riffle/Run Quality** Rated based on the depth, complexity, and functional importance of riffle/run habitat in the segment, with highest scores assigned to segments dominated by deeper riffle/run areas, stable substrates, and a variety of current velocities.

f) **Channel Alteration** Is a measure of large-scale changes in the shape of the stream channel. Channel alteration includes: concrete channels, artificial embankments, obvious straightening of the natural channel, rip-rap, or other structures, as well as recent bar development. Ratings for this metric are based on the presence of artificial structures as well as the existence, extent, and coarseness of point bars, side bars, and mid-channel bars which indicate the degree of flow fluctuations and substrate stability. Evidence of channelization may sometimes be seen in the form of berms which parallel the stream channel.

g) **Bank Stability** Rated based on the presence/absence of riparian vegetation and other stabilizing bank materials such as boulders and rootwads, and frequency/size of erosional areas. Sites with steep slopes are not penalized if banks are composed solely of stable materials.

h) **Embeddedness** Rated as a percentage based on the fraction of surface area of larger particles that is surrounded by fine sediments on the stream bottom. In low gradient streams with substantial natural deposition, the correlation between embeddedness and fishability or ecological health may be weak or non-existent, but this metric is rated in all streams to provide similar information from all sites statewide.

i) **Channel Flow Status** Rated based on the percentage of the stream channel that has water, with subtractions made for exposed substrates and islands.

j) **Shading** Rated based on estimates of the degree and duration of shading at a site during summer, including any effects of shading caused by landforms.

k) **Riparian Buffer Zone** Based on the size and type of the vegetated riparian buffer zone at the site. Cultivated fields for agriculture which have bare soil to any extent are not considered as riparian buffers. At sites where the buffer width is variable or direct delivery of storm runoff or sediment to the stream is evident or highly likely, the smallest buffer in the segment. (e.g., 0 if parking lot runoff enters directly to the stream) is measured and recorded even though some of the segment may have a well developed buffer. In cases where the riparian zone on one side of the stream slopes away from the stream and there is no direct point of entry for runoff, the buffer on the other side of the stream should be measured and recorded and a comment made in comments section of the data sheet.

l) **Aesthetic Rating** Rated based on the visual appeal of the site and presence/absence of human refuse, with highest scores assigned to stream segments with no human refuse and visually outstanding character.

m) **Remoteness** Rated based on the absence of detectable human activity and difficulty in accessing the segment.

QAO conducted proficiency examinations to evaluate the effectiveness of the training program and ensure that the participants had detailed knowledge of the sampling protocols. Members of the spring sampling crew were required to demonstrate proficiency in techniques for collecting samples for water chemistry and benthic macroinvertebrates. At least one member of the summer sampling crew was required to pass a comprehensive fish taxonomy examination. Each crew had to demonstrate proficiency in locating pre-selected stream segments using the GPS receiver and determining if the segment was acceptable for sampling. Comprehensive "dry runs" were conducted to simulate actual field conditions and evaluate classroom instruction.

Field audits were conducted by the QAO during the field sampling to assess the adequacy of training, adherence to sampling protocols, and accuracy of data transcription. The audits included evaluation of the preparation and planning prior to field sampling, stream segment location using GPS equipment and assessment of acceptability for sampling, adherence to sampling protocols, data transcription, and equipment maintenance and calibration. The QAO made an independent assessment of habitat at all segments where field audits were done, approximately 10% of the total number of sites.

At the end of each sampling year, specimens of all taxa collected were verified by an appropriate recognized authority in fish, benthic macroinvertebrate, reptile/amphibian, macrophyte, or mussel taxonomy. For benthic macroinvertebrates, a random subset of at least 5% of the preserved benthic samples was independently reprocessed in the laboratory to verify identifications.

2.3.1 Data Management

All crews used standardized pre-printed data forms developed for the Survey to ensure that all data required for a sampling segment were recorded and standard units of measure were used (Kazyak 1995). Using standard data forms facilitated developing data-entry protocols and minimized transcription error. The field crew leader and a second reviewer checked all data sheets for completeness and legibility before leaving each sampling location. Original data sheets were sent to the Data Management Officer for data entry, while copies were retained by the field crews.

A custom database application, in which the input module was designed to match each of the field data sheets used in the 1995 sampling effort was used for data entry. Whenever possible, QA/QC checks were embedded into data entry screens. Data were independently entered into two databases that were compared as a quality-control procedure. Differences between the two databases were resolved from original data sheets or through discussions with field crew leaders.

2.4 PARTICIPATING AGENCIES AND CONTRACTORS

The MBSS is a cooperative effort among several agencies and consultants, including Maryland Department of Natural Resources, Maryland Department of the Environment, University of Maryland Appalachian Environmental Laboratory, University of Maryland Agricultural Experiment Station, Coastal Environmental Services, and Versar, Inc.

3 DATA BASE INFORMATION

3.1 GUIDE TO THE DATA SETS

MBSS 1995 data are contained within 13 data sets as listed in Table 3-1. This chapter describes the contents of each data set. Data sets are available in DOS dBase III format on a 3½ inch diskette. Files were compressed into a self-extracting 166K PKZIP file named MBSS95DB.EXE. The files will be extracted automatically by typing the filename MBSS95DB (without extension). Once extracted, the files will require approximately 4.4 megabytes.

Within any of the data sets, an entry of -999 denotes missing data. In the water chemistry data, an entry of -998 indicates a value below detection limits.

Table 3-1. Index to 1995 MBSS data sets

Data	Name of Data Set
Site Locations	SITES95
Water Chemistry	WCHEM95
Benthic Macroinvertebrates	BENTH95
Fish 1. Abundance 2. Length and anomalies for gamefish 3. Anomalies for non-game fish species	 PASS1_95, PASS2_95 GAMLEN95 NGANOM95
Herpetofauna	HERPS95
Macrophytes	PLANTS95
Mussels	MUSSEL95
Stream Habitat Assessment	HABIT95
Additional Biological Sampling Information 1. Spring index period 2. Summer index period	 SPRIND95 SUMIND95

3.2 SITE LOCATIONS

The SITES95 data set (Table 3-2) contains information describing the location of each site at which samples were collected. This information includes spatial coordinates (latitude/longitude and Maryland state plane coordinates) and other site descriptors including the basin, county, stream reach, stream order, sampleability and site type based on study design. This data set includes all sites visited, whether sampled or not.

Table 3-2. Contents of the data set SITES95 containing descriptive information about sampling sites

Variable	Type	Label
BASIN	Char	Basin
COUNTY	Char	County
EASTING	Num	MD Plane Coordinate
EDITDATE	Num	Date Last Revised
LAT	Num	Latitude
LONG	Num	Longitude
MUP	Num	Distance (m) from Downstream Confluence
NORTHING	Num	MD Plane Coordinate
ORDER	Num	Strahler Order
PHYSIO	Char	Physiographic Province
REACH	Char	Stream Reach ID
REGION	Char	Geographic Region
SAMP_SPR	Char	Spring Sampleable?
SAMP_SUM	Char	Summer Sampleable?
SEGMENT	Num	Segment Number
SITE	Char	Site
SITETYPE	Num	Site Type Based on Study Design
YNOTSPR	Num	Spring - Why Not Sampled?
YNOTSUM	Num	Summer - Why Not Sampled?

3.2.1 Site Identification (SITE)

Within each sampling year, each sample segment is identified by a unique identification code (SITE). The variable SITE, in combination with sampling date (SAMPDATE), is used in each of the other MBSS data sets to identify the sample segment at which data were collected. These common fields can be used to merge different data files or to set up a relational database.

1995 SITE identifiers are 12-character codes made up of four parts: COUNTY-PHYSIO-reach i.d.-SEGMENT. For 1995 sites, the 3-digit SEGMENT code is a unique identifier for a segment within the basin, with the first digit signifying stream order.

> Example: 1995 site CH-S-062-314 is located in Charles County (CH), within the Southern Coastal Plain physiographic province (S) and stream reach 062. The segment code 314 is a unique identifier for this site within the basin and also signifies the site is located on a third order stream.

3.2.2 Geographic Region (REGION)

The variable REGION specifies one of 3 geographic regions within the state of Maryland. A one-letter code for the variable REGION specifies whether a site is located within West (W), Central (C), or East (E) Maryland. The 18 Maryland basins sampled by the MBSS were divided among these 3 regions (Table 2-1).

3.2.3 Drainage Basin (BASIN)

Sampling sites for the MBSS were located in 18 distinct drainage basins (Figure 2-1). A basin is specified by a two-letter code (BASIN). Entries for the variable BASIN are given in Table 3-3. Six basins were sampled in 1995 (Table 2-1).

3.2.4 County (COUNTY)

The variable COUNTY specifies one of 24 counties within the state of Maryland, as designated by political boundaries. Two-letter codes for the variable COUNTY are given in Table 3-4.

3.2.5 Physiographic Province (PHYSIO)

The variable PHYSIO specifies one of six physiographic provinces within the state of Maryland (Figure 3-1). One-letter codes for the variable PHYSIO are given in Table 3-5. The PHYSIO code is included as the second part of the SITE code.

Table 3-3. MBSS drainage basins, represented by the variable BASIN

Drainage Basin Name	Code
Bush River	BU
Choptank River	CK
Chester River	CR
Elk River	EL
Gunpowder River	GU
Lower Potomac River	LP
Middle Potomac River	MP
North Branch Potomac River	NO
Nanticoke/Wicomico Rivers	NW
Ocean Coastal	OC
Pocomoke River	PC
Patapsco River	PP
Potomac Washington Metro	PW
Patuxent River	PX
Lower Susquehanna River	SQ
Upper Potomac River	UP
West Chesapeake	WC
Youghiogheny River	YG

3.2.6 Stream Reach (REACH)

A stream reach is the section between two adjacent confluences of a stream, or between the head of the stream and the downstream confluence. The variable REACH is three part code identifying a specific stream reach. A complete REACH code identification is made up of three parts: COUNTY-PHYSIO-reach i.d. The 3-digit reach i.d. is also included as the third part of the SITE code.

Table 3-4. Entries for the variable COUNTY

County	Code
Allegany	AL
Anne Arundel	AA
Baltimore City	BC
Baltimore	BA
Calvert	CA
Caroline	CN
Carroll	CR
Cecil	CE
Charles	CH
Dorchester	DO
Frederick	FR
Garrett	GA
Harford	HA
Howard	HO
Kent	KE
Montgomery	MO
Prince George's	PG
Queen Anne's	QA
St. Mary's	SM
Somerset	SO
Talbot	TA
Washington	WA
Wicomico	WI
Worcester	WO

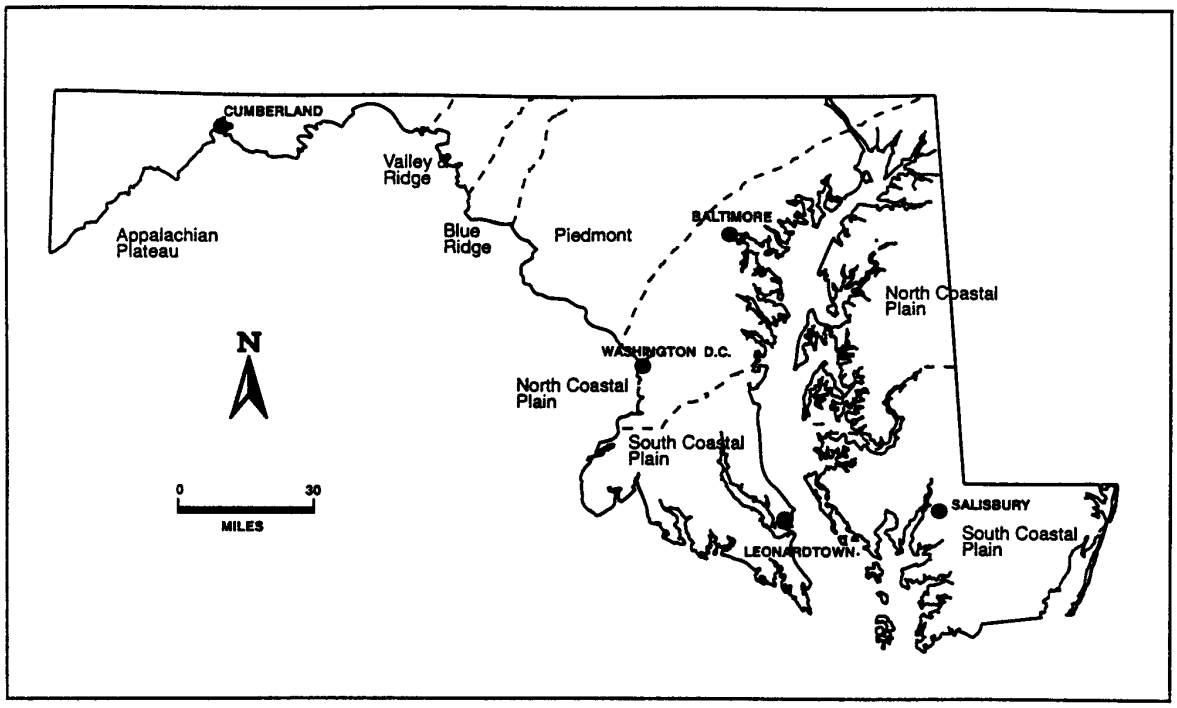

Figure 3-1. Physiographic provinces of Maryland

Table 3-5. Entries for physiographic province, represented by the variable PHYSIO

Physiographic Province	Code
Appalachian Plateau	A
Blue Ridge	B
North Coastal Plain	N
Piedmont	P
South Coastal Plain	S
Valley and Ridge	V

3.2.7 Sample Segment (SEGMENT)

Each MBSS sample site was a 75-meter long stream segment. The variable SEGMENT identifies each sample site and is included as the fourth and final part of the SITE code.

For 1995 sites, the 3-digit SEGMENT code is a unique identifier for a segment within a basin. The first digit of this 3-digit SEGMENT code indicates stream order (1 = 1st order stream, 2 = 2nd order, 3 = 3rd order).

3.2.8 Stream Order (ORDER)

The variable ORDER represents stream order. The Strahler convention (Strahler 1957) was used for ranking stream reaches by order; first order reaches, for example, are the most upstream reaches in the branching stream system. Site selection and stream order determinations were based on a stream reach file digitized from 1:250,000 scale topographic maps for the MSSCS in 1987. In some cases, stream order determined using this method may differ from stream order determined from a 1:24,000 scale topographic map.

3.2.9 Site Type, Based on Study Design (SITETYPE)

The categorical variable SITETYPE has two levels, (1) and (2), describing the survey design used for selecting the location of the site:

- Category 1 -- sites selected according to the statewide MBSS sampling design. These were selected using stratified random sampling within each basin, with the number of sites in each basin being proportional to the respective stream lengths for each stream order. Each basin has the same expected number of category 1 sites per mile for each stratum (stream order). The inclusion probabilities for category 1 sites are equal across basins for each stream order.

- Category 2 -- sites selected to enhance the sampling density in some basins. These were selected using stratified random sampling of sites within the basin, with varying sampling density in each basin and stream order. These sites augment the category 1 sites for some basins, but do not have equal inclusion probabilities across basins.

  Observations from category 2 sites are not independent and identically distributed across basins. The category 2 sites should not be used for standard analytical procedures such as regression analysis and analysis of variance (ANOVA) across basins. All sites (category 1 and 2) can be used to estimate means, totals, and proportions both within and across basins, using appropriate weighting procedures.

3.2.10 Spring Sampleability (SAMP_SPR)

Spring sampleability (SAMP_SPR) indicates whether or not a preselected site was able to be sampled during the spring index period. Sampleability is indicated by a yes (Y) or no (N).

3.2.11 Reason For Not Sampling in Spring (YNOTSPR)

If a segment could not be sampled during the spring index period, YNOTSPR indicates the reason why a segment was deemed unsampleable. Codes for the variable YNOTSPR are listed in Table 3-6.

Table 3-6. Reasons why a stream segment could not be sampled during either the spring (YNOTSPR) or summer (YNOTSUM) index period

Reason	Code
Dry Streambed	1
Too Deep	2
Marsh, no defined channel	3
Excessive Riparian Vegetation	4
Impoundment	5
Tidally Influenced	6
Permission Denied	7
Unsafe	8
Beavers	9
Other	10

3.2.12 Summer Sampleability (SAMP_SUM)

Summer sampleability (SAMP_SUM) indicates whether or not a preselected site was able to be sampled during the summer index period. Sampleability is indicated by a yes (Y) or no (N).

3.2.13 Reason For Not Sampling in Summer (YNOTSUM)

If a segment could not be sampled during the summer index period, YNOTSUM indicates the reason why a segment was deemed unsampleable. Codes for the variable YNOTSUM are listed in Table 3-6.

3.2.14 Latitude and Longitude (LAT, LONG)

The location of the sample site is specified using a pair of geographic coordinates, latitude (LAT) and longitude (LONG). LAT and LONG, given in positive decimal degrees, refer to the location on the 1:250,000 base map used for sample selection. Maps of this scale are accurate to approximately 200 m.

3.2.15 Maryland State Plane Coordinates (NORTHING, EASTING)

Using the Maryland State Plane Coordinate System, the geographic location of the sample site is specified using a pair of coordinates (NORTHING and EASTING). MBSS Maryland State Plane Coordinates are based on the North American Datum of 1927, the basis of the 1939 Maryland Coordinate System. A site's location is designated by the distance north (NORTHING) and east (EASTING) of an imaginary point of origin, fixed at a point southwest of the state. NORTHING and EASTING are given in feet.

3.2.16 Meters Upstream (MUP)

Meters upstream (MUP) represents the distance upstream that a site is located from the nearest downstream confluence. MUP is the distance, in meters, between the downstream origin of a sample segment and the nearest downstream confluence.

3.2.17 Edit Date (EDITDATE)

Edit date (EDITDATE) refers to the date when a data set was last revised.

3.3 WATER CHEMISTRY

The data set WCHEM95 contains water chemistry data from spring index period sampling. Samples collected during the spring index period were analyzed in the laboratory for pH, ANC, sulfate, nitrate, conductivity, and DOC (Table 3-7).

Note: Summer field measurements of pH (PH_FLD), conductivity (COND_FLD), dissolved oxygen (DO), and temperature (TEMP) are found in the SUMIND95 data set.

Table 3-7. Contents of the data set WCHEM95 containing water quality data from laboratory analyses (spring index period)

Variable	Type	Label
ANC	Num	Acid Neutralizing Capacity (μeq/L)
COND_LAB	Num	Conductivity (μmho/cm), Lab
DOC	Num	Dissolved Organic Carbon (mg/L)
EDITDATE	Num	Date Last Revised
NO3	Num	Nitrate Nitrogen (mg/L)
PH_LAB	Num	pH, Lab
SAMPDATE	Num	Date Sampled
SITE	Char	Sample Segment ID
SO4	Num	Sulfate (mg/L)

3.3.1 Site Identifiers (SITE, EDITDATE, SAMPDATE)

The variable SITE identifies the sample segment at which the data were collected. Sample date (SAMPDATE) refers to the date that samples were collected. Edit date (EDITDATE) refers to the date when the data set was last revised. Both SAMPDATE and EDITDATE appear in the form MM/DD/YY, where MM is the month, DD the day, and YY the year (e.g., 03/31/94).

3.3.2 pH (PH_LAB)

The spring pH is given in standard pH units.

3.3.3 ANC (ANC)

Acid neutralizing capacity is given in :eq/L.

3.3.4 Sulfate (SO_4), Nitrate (NO_3), and Dissolved Organic Carbon (DOC)

Sulfate, nitrate nitrogen, and dissolved organic carbon concentrations are given as mg/L.

3.3.5 Conductivity (COND_LAB)

Conductivity is given in :mho/cm.

3.4 BENTHIC MACROINVERTEBRATES

The data set BENTH95 (Table 3-8) contains data on benthic macroinvertebrates collected at each site during the spring index period. Benthic fauna were collected from a variety of instream habitats. The sample was transferred to a gridded pan and organisms were picked from randomly selected grid cells until the cell that contained the 100th individual was completed. These data provide an estimate of proportions of different taxa sampled, but do not provide information on abundance. Note that actual abundance could greatly exceed the number of individuals in the sample. Benthic macroinvertebrates were identified to family level. Each record in the data set BENTH95 refers to one site, with each taxa listed as a separate variable.

Table 3-8. Contents of the data set BENTH95 containing benthic macroinvertebrate data

Variable	Type	Label/Taxa Name
EDITDATE	Num	Date Last Revised
SAMPDATE	Num	Date Sampled
SITE	Char	Site
AESHNIDA	Num	Aeshnidae
AGRIONID	Num	Agrionidae
ANCYLIDA	Num	Ancylidae
ASELLIDA	Num	Asellidae
ASTACIDA	Num	Astacidae
ATHERHAG	Num	Athercidae/Rhagionidae Complex
BAETIDAE	Num	Baetidae
BELOSTOM	Num	Belostomatidae
BITHYNII	Num	Bithyniidae
BLEPHARI	Num	Blephariceridae
BRACHYCE	Num	Brachycentridae

Table 3-8. Cont'd

Variable	Type	Label/Taxa Name
CAENIDAE	Num	Caenidae
CALAMOCE	Num	Calamoceratidae
CAPNIIDA	Num	Capniidae
CERATOPO	Num	Ceratopogonidae
CHAOBORI	Num	Chaoboridae
CHIRONOM	Num	Chironomidae
CHLOROPE	Num	Chloroperlidae
CLADOCER	Num	Cladocera
COENAGRI	Num	Coenagrionidae
CORBICUL	Num	Corbiculidae
CORDULEG	Num	Cordulegastridae
CORIXIDA	Num	Corixidae
CORYDALI	Num	Corydalidae
CRANGONY	Num	Crangonyctidae
CULICIDA	Num	Culicidae
DIPTERA	Num	Diptera
DIXIDAE	Num	Dixidae
DRYOPIDA	Num	Dryopidae
DYTISCID	Num	Dytiscidae
ELMIDAE	Num	Elmidae
EMPIDIDA	Num	Empididae
EPHEMERI	Num	Ephemeridae
EPHEMRLL	Num	Ephemerellidae
GAMMARID	Num	Gammaridae
GLOSSIPH	Num	Glossiphoniidae
GLOSSOSO	Num	Glossosomatidae
GOMPHIDA	Num	Gomphidae

Table 3-8. Cont'd

Variable	Type	Label/Taxa Name
GYRINIDA	Num	Gyrinidae
HALIPLID	Num	Haliplidae
HELICOPS	Num	Helicopsychidae
HEPTAGEN	Num	Heptageniidae
HIRUDINE	Num	Hirudinea
HYDROBII	Num	Hydrobiidae
HYDROPHI	Num	Hydrophilidae
HYDROPSY	Num	Hydropsychidae
HYDROPTI	Num	Hydroptilidae
LEPIDOST	Num	Lepidostomatidae
LEPTOCER	Num	Leptoceridae
LEPTOPHL	Num	Leptophlebiidae
LEUCTRID	Num	Leuctridae
LIBELLUL	Num	Libellulidae
LIMNEPHI	Num	Limnephilidae
LUMBRICU	Num	Lumbriculidae
LYMNAEID	Num	Lymnaeidae
MACROMID	Num	Macromidae
METRETOP	Num	Metretopodidae
MOLANNID	Num	Molannidae
NAIDIDAE	Num	Naididae
NEMOURID	Num	Nemouridae
ODONTOCE	Num	Odontoceridae
OLIGOCHA	Num	Oligochaeta
OLIGONEU	Num	Oligoneuridae
PALAEMON	Num	Palaemonidae
PELTOPER	Num	Peltoperlidae

Table 3-8. Cont'd

Variable	Type	Label/Taxa Name
PERLIDAE	Num	Perlidae
PERLODID	Num	Perlodidae
PHILOPOT	Num	Philopotamidae
PHRYGANE	Num	Phryganeidae
PHYSIDAE	Num	Physidae
PLANARII	Num	Planariidae
PLANORBI	Num	Planorbidae
PLEUROCE	Num	Pleuroceridae
POLYCENT	Num	Polycentropodidae
PSEPHENI	Num	Psephenidae
PSYCHOMY	Num	Psychomyiidae
PTERONAR	Num	Pteronarcyidae
PTILODAC	Num	Ptilodactylidae
PYRALIDI	Num	Pyralididae
RHYACOPH	Num	Rhyacophilidae
SCIOMYZI	Num	Sciomyzidae
SCIRTIDA	Num	Scirtidae
SERICOST	Num	Sericostomatidae
SIALIDAE	Num	Sialidae
SIMULIID	Num	Simuliidae
SIPHLONU	Num	Siphlonuridae
SISYRIDA	Num	Sisyridae
SPHAERII	Num	Sphaeriidae
STRATIOM	Num	Stratiomyidae
TABANIDA	Num	Tabanidae
TAENIOPT	Num	Taeniopterygidae
TALITRID	Num	Talitridae

Table 3-8. Cont'd

Variable	Type	Label/Taxa Name
TIPULIDA	Num	Tipulidae
UENOIDAE	Num	Uenoidae
UNIONIDA	Num	Unionidae
VELIIDAE	Num	Veliidae
VIVIPARI	Num	Viviparidae

3.4.1 Site Identifiers (SITE, EDITDATE, SAMPDATE)

The variable SITE identifies the sample segment at which the data were collected. Sample date (SAMPDATE) refers to the date that samples were collected. Edit date (EDITDATE) refers to the date when the data set was last revised. Both SAMPDATE and EDITDATE appear in the form MM/DD/YY, where MM is the month, DD the day, and YY the year (e.g., 03/31/94).

3.4.2 Benthic taxa counts

The names of benthic taxa collected are represented by a series of variables, each up to eight characters long (e.g., AESHNIDA for Aeshnidae; see Table 3-8). The value of each variable signifies the number of individuals of that taxa counted, of the roughly 100 total individuals identified.

For example, in the data set BENTH95, a record for one hypothetical site would include the following:

SITE	EDITDATE	SAMPDATE	AESHNIDA	AGRIONID	ANCYLIDA...	
XX-X-123-123	03/11/96	03/15/95	4	0	0	...

The value of "4" for AESHNIDA means four individuals of the family Aeshnidae were counted. In addition, no members of the groups Agrionidae or Ancylidae were counted.

3.5 FISH

MBSS fish data include the identification and abundance of species collected within each of two electrofishing passes during the summer index period. Additional data on gamefish length and the frequency and type of visible anomalies are also included.

3.5.1 Abundance

The data sets PASS1_95 and PASS2_95 contain the presence and abundance of fish species collected during each of two sequential electrofishing passes conducted along the 75 meter sample segment (Table 3-9). Both gamefish and non-game fish species are included. Each record in these data sets refers to one site, with the abundance of each fish species listed as a separate variable.

Table 3-9. Contents of the data sets PASS1_95 and PASS2_95 containing data on the presence and abundance of fish species collected on each of two electrofishing passes

Variable	Type	Label/Common Name	Scientific Name
EDITDATE	Num	Date Last Revised	
SAMPDATE	Num	Date Sampled	
SITE	Char	Site	
AMEREEL	Num	AMERICAN EEL	*Anguilla rostrata*
BANKILLI	Num	BANDED KILLIFISH	*Fundulus diaphanus*
BKNODACE	Num	BLACKNOSE DACE	*Rhinichthys atratulus*
BLKCRAPI	Num	BLACK CRAPPIE	*Pomoxis nigromaculatus*
BLSPSUNF	Num	BLUESPOTTED SUNFISH	*Enneacanthus gloriosus*
BLUEGILL	Num	BLUEGILL	*Lepomis macrochirus*
BLUNMINN	Num	BLUNTNOSE MINNOW	*Pimephales notatus*
BRKTROUT	Num	BROOK TROUT	*Salvelinus fontinalis*
BRNTROUT	Num	BROWN TROUT	*Salmo trutta*
BRWNBULL	Num	BROWN BULLHEAD	*Ameiurus nebulosus*
CENSTROL	Num	CENTRAL STONEROLLER	*Campostoma anomalum*
CHKSCULP	Num	CHECKERED SCULPIN	*Cottus* sp. n.
CHNPIKRL	Num	CHAIN PICKEREL	*Esox niger*
COMMCARP	Num	COMMON CARP	*Cyprinus carpio*
COMSHINR	Num	COMMON SHINER	*Luxillus cornutus*
CREKCHUB	Num	CREEK CHUB	*Semotilus atromaculatus*

Table 3-9. Cont'd

Variable	Type	Label/Common Name	Scientific Name
CRKCHBSK	Num	CREEK CHUBSUCKER	*Erimyzon oblongus*
CUTLMINW	Num	CUTLIPS MINNOW	*Exoglossum maxillingua*
EMUDMINW	Num	EASTERN MUDMINNOW	*Umbra pygmaea*
ESILVMIN	Num	EASTERN SILVERY MINNOW	*Hybognathus regius*
FALLFISH	Num	FALLFISH	*Semotilus corporalis*
FANTDART	Num	FANTAIL DARTER	*Etheostoma flabellare*
FATHMINW	Num	FATHEAD MINNOW	*Pimephales promelas*
FLIER	Num	FLIER	*Centrarchus macropterus*
GLASDART	Num	GLASSY DARTER	*Etheostoma vitreum*
GLDNSHNR	Num	GOLDEN SHINER	*Notemigonus crysoleucas*
GRNDARTR	Num	GREENSIDE DARTER	*Etheostoma blennioides*
GRSUNFSH	Num	GREEN SUNFISH	*Lepomis cyanellus*
IRNCSHIN	Num	IRONCOLOR SHINER	*Notropis chalybaeus*
JOHNDART	Num	JOHNNY DARTER	*Etheostoma nigrum*
LEPOMHYB	Num	LEPOMIS HYBRID	
LGMTHBAS	Num	LARGEMOUTH BASS	*Micropterus salmoides*
LONGDACE	Num	LONGNOSE DACE	*Rhinichthys cataractae*
LSTBKLMP	Num	LEAST BROOK LAMPREY	*Lampetra aepyptera*
MARGMDTM	Num	MARGINED MADTOM	*Noturus insignis*
MOSQFISH	Num	MOSQUITOFISH	*Gambusia holbrooki*
MTLSCULP	Num	MOTTLED SCULPIN	*Cottus bairdi*
MUDSUNFI	Num	MUD SUNFISH	*Acantharchus pomotis*
MUMICHOG	Num	MUMMICHOG	*Fundulus heteroclitus*
NHOGSUKR	Num	NORTHERN HOGSUCKER	*Hypentelium nigricans*
PERLDACE	Num	PEARL DACE	*Margariscus margarita*
PIRPERCH	Num	PIRATE PERCH	*Aphredoderus sayanus*
POTSCULP	Num	POTOMAC SCULPIN	*Cottus girardi*

Table 3-9. Cont'd

Variable	Type	Label/Common Name	Scientific Name
PUMPSEED	Num	PUMPKINSEED	*Lepomis gibbosus*
REDBRSUN	Num	REDBREAST SUNFISH	*Lepomis auritus*
REDPIKRL	Num	REDFIN PICKEREL	*Esox americanus*
RIVRCHUB	Num	RIVER CHUB	*Nocomis micropogon*
RNBTROUT	Num	RAINBOW TROUT	*Oncorhynchus mykiss*
ROCKBASS	Num	ROCK BASS	*Ambloplites rupestris*
ROSYDACE	Num	ROSYSIDE DACE	*Clinostomus elongatus*
ROSYSHIN	Num	ROSYFACE SHINER	*Notropis rubellus*
SATFINSH	Num	SATINFIN SHINER	*Cyprinella analostana*
SEALAMPR	Num	SEA LAMPREY	*Petromyzon marinus*
SJAWMINW	Num	SILVERJAW MINNOW	*Notropis buccatus*
SMMTHBAS	Num	SMALLMOUTH BASS	*Micropterus dolomieu*
SPFNSHIN	Num	SPOTFIN SHINER	*Cyprinella spilopterus*
SPTLSHIN	Num	SPOTTAIL SHINER	*Notropis hudsonius*
STRPSHIN	Num	STRIPED SHINER	*Luxillus chrysocephalus*
SWMPDART	Num	SWAMP DARTER	*Etheostoma fusiforme*
SWSHINER	Num	SWALLOWTAIL SHINER	*Notropis procne*
TADPMADT	Num	TADPOLE MADTOM	*Noturus gyrinus*
TESSDART	Num	TESSELLATED DARTER	*Etheostoma olmstedi*
WARMOUTH	Num	WARMOUTH	*Lepomis gulosus*
WHTPERCH	Num	WHITE PERCH	*Morone americana*
WHTSUCKR	Num	WHITE SUCKER	*Catostomus commersoni*
YLLWBULH	Num	YELLOW BULLHEAD	*Ameiurus natalis*
YLLWPRCH	Num	YELLOW PERCH	*Perca flavescens*

3.5.1.1 Site Identifiers (SITE, EDITDATE, SAMPDATE)

The variable SITE identifies the sample segment at which the data were collected. Sample date (SAMPDATE) refers to the date that samples were collected. Edit date (EDITDATE) refers to the date when the data set was last revised. Both SAMPDATE and EDITDATE appear in the form MM/DD/YY, where MM is the month, DD the day, and YY the year (e.g., 03/31/94).

3.5.1.2 Species Abundance

The names of fish species collected are represented by a series of variables, each up to eight characters long (e.g., AMEREEL for American eel; see Table 3-9). The value of each variable signifies the number of individuals of that species collected.

For example, in the data set PASS1_95, a record for one hypothetical site would include the following:

SITE	EDITDATE	SAMPDATE	AMEREEL	BANKILLI	BKNODACE...
XX-X-123-123	03/15/96	07/15/95	3	0	37 ...

The value of "3" for AMEREEL means three American eels were caught on the first pass. In addition, thirty-seven blacknose dace were captured, while no banded killifish were caught on the first pass.

3.5.2 Length and Anomalies for Gamefish

The data set GAMLEN95 contains data for individual gamefish, including the total length of the individual and occurrence of any visible external pathology or anomalies (Table 3-10). Each record in the GAMLEN95 data set refers to an individual gamefish collected during the two electrofishing passes.

Table 3-10. Contents of the data set GAMLEN95 containing data for individual gamefish, including individual total lengths and occurrence of visible external pathology or anomalies

Variable	Type	Label
AN	Num	Swelling of the Anus
AW	Num	Anchor Worm
BL	Num	Black Spot

Table 3-10. Continued

Variable	Type	Label
BS	Num	Body Shape
CA	Num	Cataract
CL	Num	Fin Cloudiness
CT	Num	Cut
DI	Num	Discoloration
DM	Num	Deformities of the Mandible
DV	Num	Deformities of the Vertebral Column
EC	Num	Eye Cloudiness
EDITDATE	Num	Date Last Revised
EH	Num	Eye Hemorrhage
EP	Num	Visible External Parasites
FD	Num	Fin Deformed or Missing
FI	Num	Fin Erosion
FU	Num	Fungus
GR	Num	Growths/Cysts
HK	Num	Hooking Injury
HM	Num	Hemorrhaging
IK	Num	Ich
LE	Num	Leeches
LEN_ID	Num	Length ID
LENGTH	Num	Length (mm)
NO	Num	Eye Missing
OR	Num	Depression into the Orbits
OT	Num	Other
PASS	Num	Electrofishing Pass No.
PO	Num	Exopthalmia (pop eye)

Table 3-10. Continued

Variable	Type	Label
RE	Num	Red Spot
RS	Num	Raised Scales
SAMPDATE	Num	Date Sampled
SC	Num	Scale Deformities
SITE	Char	Site
SPECIES	Char	Gamefish Species
UL	Num	Ulcerations/Lesions

3.5.2.1 Site Identifiers (SITE, EDITDATE, SAMPDATE)

The variable SITE identifies the sample segment at which the data were collected. Sample date (SAMPDATE) refers to the date that samples were collected. Edit date (EDITDATE) refers to the date when the data set was last revised. Both SAMPDATE and EDITDATE appear in the form MM/DD/YY, where MM is the month, DD the day, and YY the year (e.g., 03/31/94).

3.5.2.2 Species (SPECIES)

In this data set, the variable SPECIES is the species name for the individual gamefish examined.

3.5.2.3 Pass (PASS)

PASS denotes whether an individual was captured on the first (1) or second (2) electrofishing pass.

3.5.2.4 Length (LENGTH) and Length ID (LEN_ID)

For each pass, 50 individuals of each gamefish species (or all individuals captured, whichever was fewer) were measured in the field. Total length for each individual (LENGTH) is given in millimeters. LEN_ID is an identifier for each individual measured at a site.

3.5.2.5 Anomalies

All individuals measured were examined for the presence of gross external pathology or anomalies. Additional fish were examined, up to a total of 100 individuals per species for both passes at a site. In the GAMLEN95 data set, each type of anomaly is listed as a separate variable; codes for the anomaly variables are listed in Table 3-10. For an individual fish, the occurrence of each anomaly is indicated by presence (1) or absence (0).

3.5.3 Anomalies for Non-game Fish Species

The data set NGANOM95 contains information on the occurrence of visible external pathology or anomalies within non-game fish species captured (Table 3-11). Non-game fish were grouped by species for examination. Each record in the NGANOM95 data set refers to a non-game fish species collected during the two electrofishing passes.

Table 3-11. Contents of the data set NGANOM95 containing data on the occurrence of visible external pathology or anomalies among non-game fish species

Variable	Type	Label
AN	Num	Swelling of the Anus
AW	Num	Anchor Worm
BL	Num	Black Spot
BS	Num	Body Shape
CA	Num	Cataract
CL	Num	Fin Cloudiness
CT	Num	Cut
DI	Num	Discoloration
DM	Num	Deformities of the Mandible
DV	Num	Deformities of the Vertebral Column
EC	Num	Eye Cloudiness
EDITDATE	Num	Date Last Revised
EH	Num	Eye Hemorrhage
EP	Num	Visible External Parasites
FD	Num	Fin Deformed or Missing

Table 3-11. Continued

Variable	Type	Label
FI	Num	Fin Erosion
FU	Num	Fungus
GR	Num	Growths/Cysts
HK	Num	Hooking Injury
HM	Num	Hemorrhaging
IK	Num	Ich
LE	Num	Leeches
NO	Num	Eye Missing
NUMEXAM	Num	Number Examined
OR	Num	Depression into the Orbits
OT	Num	Other
PO	Num	Exopthalmia (pop eye)
RE	Num	Red Spot
RS	Num	Raised Scales
SAMPDATE	Num	Date Sampled
SC	Num	Scale Deformities
SITE	Char	Site
SPECIES	Char	Nongame Fish Species
UL	Num	Ulcerations/Lesions

3.5.3.1 Site Identifiers (SITE, EDITDATE, SAMPDATE)

The variable SITE identifies the sample segment at which the data were collected. Sample date (SAMPDATE) refers to the date that samples were collected. Edit date (EDITDATE) refers to the date when the data set was last revised. Both SAMPDATE and EDITDATE appear in the form MM/DD/YY, where MM is the month, DD the day, and YY the year (e.g., 03/31/94).

3.5.3.2 Species (SPECIES)

In this data set, the variable SPECIES is the species name for the non-game fish examined.

3.5.3.3 Number Examined (NUMEXAM)

One hundred individuals (or all individuals captured, whichever was fewer) of each non-game species were examined for the presence of gross external pathology or anomalies. NUMEXAM is the number of individuals of each non-game species actually examined.

3.5.3.4 Anomalies

Each type of anomaly is listed as a separate variable; codes for anomaly types are listed in Table 3-12. The value entered for each anomaly specifies the number of individuals of that species exhibiting a particular anomaly.

3.6 HERPETOFAUNA

The data set HERPS95 (Table 3-12) contains presence/absence data on herpetofauna (reptiles and amphibians) collected within each 75 meter sample segment and its adjacent riparian area during the summer index period. Herpetofauna were collected during electrofishing passes and by examination of representative habitats within 5 m of the stream segment.

Table 3-12. Contents of the data set HERPS95 containing reptile and amphibian data

Variable	Type	Label/Common Name	Scientific Name
EDITDATE	Num	Date Last Revised	
SAMPDATE	Num	Date Sampled	
SITE	Char	Site	
AMTOAD	Num	AMERICAN TOAD	*Bufo americanus*
BLRATSNK	Num	BLACK RAT SNAKE	*Elaphe o. obsoleta*
BULLFROG	Num	BULLFROG	*Rana catesbeiana*
EBOXTURT	Num	EASTERN BOX TURTLE	*Terrapene c. carolina*
EGARSNAK	Num	EASTERN GARTER SNAKE	*Thamnophis s. sirtalis*

Table 3-12. Cont'd

Variable	Type	Label/Common Name	Scientific Name
EMUDSALA	Num	EASTERN MUD SALAMANDER	*Pseudotriton m. montanus*
EMUDTURT	Num	EASTERN MUD TURTLE	*Kinosternon s. subrubrum*
EPAITURT	Num	EASTERN PAINTED TURTLE	*Chrysemys p. picta*
ESMESNAK	Num	EASTERN SMOOTH EARTH SNAKE	*Virginia v. valeriae*
EWRMSNAK	Num	EASTERN WORM SNAKE	*Carphophis a. amoenus*
FIVLSKNK	Num	FIVE-LINED SKINK	*Eumeces fasciatus*
FROG	Num	FROG (UNKNOWN)	
FWLRTOAD	Num	FOWLER'S TOAD	*Bufo woodhousii fowleri*
GRENFROG	Num	GREEN FROG	*Rana clamitans melanota*
LNGTLSAL	Num	LONGTAIL SALAMANDER	*Eurycea l. longicauda*
MARBSALA	Num	MARBLED SALAMANDER	*Ambystoma opacum*
MNDSKSAL	Num	MOUNTAIN DUSKY SALAMANDER	*Desmognathus ochrophaeus*
MUSKTURT	Num	COMMON MUSK TURTLE	*Sternotherus odoratus*
N2LINSAL	Num	NORTHERN TWO-LINED SALAMANDER	*Eurycea bislineata*
NBLKRACR	Num	NORTHERN BLACK RACER	*Coluber c. constrictor*
NCRKFROG	Num	NORTHERN CRICKET FROG	*Acris c. crepitans*
NDSKYSAL	Num	NORTHERN DUSKY SALAMANDER	*Desmognathus f. fuscus*
NFENLIZD	Num	NORTHERN FENCE LIZARD	*Sceloporus undulatus hyacinthinus*
NRNGSNAK	Num	NORTHERN RINGNECK SNAKE	*Diadophis punctatus edwardsii*
NSLIMSAL	Num	NORTHERN SLIMY SALAMANDER	*Plethodon glutinosus*
NSPRPEEP	Num	NORTHERN SPRING PEEPER	*Pseudacris c. crucifer*

Table 3-12. Cont'd

Variable	Type	Label/Common Name	Scientific Name
NSPRSALA	Num	NORTHERN SPRING SALAMANDER	*Gyrinophilus porphyriticus*
NWATSNAK	Num	NORTHERN WATER SNAKE	*Nerodia s. sipedon*
PICKFROG	Num	PICKEREL FROG	*Rana palustris*
PLETHSAL	Num	PLETHODONTID SALAMANDER (UNKNOWN)	
QUENSNAK	Num	QUEEN SNAKE	*Regina septemvittata*
RANIFROG	Num	RANID FROG (UNKNOWN)	
REDBSALA	Num	REDBACK SALAMANDER	*Plethodon cinereus*
REDBTURT	Num	REDBELLY TURTLE	*Pseudemys rubriventris*
REDSALAM	Num	RED SALAMANDER	*Pseudotriton ruber*
REDSPNWT	Num	RED SPOTTED NEWT	*Notopthalmus v. viridescens*
SALAMAND	Num	SALAMANDER (UNKNOWN)	
SELSALAM	Num	SEAL SALAMANDER	*Desmognathus monticola*
SLEOFROG	Num	SOUTHERN LEOPARD FROG	*Rana utricularia*
SMGRSNAK	Num	SMOOTH GREEN SNAKE	*Opheodrys vernalis*
SNAPTURT	Num	COMMON SNAPPING TURTLE	*Chelydra serpentina*
TOAD	Num	TOAD (UNKNOWN)	
WOODFROG	Num	WOOD FROG	*Rana sylvatica*
WOODTURT	Num	WOOD TURTLE	*Clemmys insculpta*

3.6.1 Site Identifiers (SITE, EDITDATE, SAMPDATE)

The variable SITE identifies the sample segment at which the data were collected. Sample date (SAMPDATE) refers to the date that samples were collected. Edit date (EDITDATE) refers to the date when the data set was last revised. Both SAMPDATE and EDITDATE appear in the form MM/DD/YY, where MM is the month, DD the day, and YY the year (e.g., 03/31/94).

3.6.2 Herpetofauna Taxa Presence

The names of herpetofauna taxa observed are represented by a series of variables, each up to eight characters long (e.g., AMTOAD for American toad; see Table 3-12). The value of each variable indicates the presence (1) or absence (0) of the taxa.

For example, in the data set HERPS95, a record for one hypothetical site would include the following:

SITE	EDITDATE	SAMPDATE	AMTOAD	BLRATSNK	BULLFROG...
XX-X-123-123	03/15/96	07/15/95	0	0	1 ...

The value of "1" for BULLFROG means bullfrogs were present. American toads and black rat snakes were absent.

3.7 MACROPHYTES

The data set PLANTS95 (Table 3-13) contains presence/absence data on macrophytes (including both submerged and emergent aquatic vegetation) found within each 75 meter sample segment during the summer index period. The presence of macrophytes was observed at the time of electrofishing, by examination of the stream segment. Plants were identified to species when possible. Otherwise, a higher-level taxonomic identifier is given.

Table 3-13. Contents of the data set PLANTS95 containing aquatic vegetation data

Variable	Type	Label/Common Name	Scientific Name
EDITDATE	Num	Date Last Revised	
SAMPDATE	Num	Date Sampled	
SITE	Char	Site	
ALSUBCOR	Num	COMMON WATER PLANTAIN	*Alisma subcordatum*
CALITRHE	Num	LARGER WATER-STARWORT	*Callitriche heterophylla*
CALITRSP	Num	WATER-STARWORT	*Callitriche* sp.
CERATODE	Num	COONTAIL	*Ceratophyllum demersum*
ELODCANA	Num	ELODEA	*Elodea canadensis*
HYDROCOT	Num	WATER PENNYWORT	*Hydrocotyle* sp.

Table 3-13. Cont'd

Variable	Type	Label-Common Name	Scientific Name
LEMNASP	Num	DUCKWEED	*Lemna* sp.
LUDWPALU	Num	WATER PURSLANE	*Ludwigia palustris*
LUDWIGIA	Num	FALSE LOOSESTRIFE	*Ludwigia* sp.
NAJASSP	Num	NAIAD	*Najas* sp.
NASTOFFI	Num	WATERCRESS	*Nasturtium officinale*
NUPHRADV	Num	SPATTERDOCK	*Nuphar advena*
PLTVIRGA	Num	ARROW ARUM	*Peltandra virginica*
PONTCORD	Num	PICKERELWEED	*Pontederia cordata*
POTMOEPI	Num	FLOATING PONDWEED	*Potamogeton epihydrus*
POTMOGTN	Num	PONDWEED	*Potamogeton* sp.
SPARGNSP	Num	BURREED	*Sparganium* sp.
TYPHASP	Num	CATTAIL	*Typha* sp.

3.7.1 Site Identifiers (SITE, EDITDATE, SAMPDATE)

The variable SITE identifies the sample segment at which the data were collected. Sample date (SAMPDATE) refers to the date that samples were collected. Edit date (EDITDATE) refers to the date when the data set was last revised. Both SAMPDATE and EDITDATE appear in the form MM/DD/YY, where MM is the month, DD the day, and YY the year (e.g., 03/31/94).

3.7.2 Macrophyte Taxa Presence

The names of macrophyte taxa observed are represented by a series of variables, each up to eight characters long (e.g., ALSUBCOR for *Alisma subcordatum*, the common water plantain; see Table 3-13). The value of each variable indicates the presence (1) or absence (0) of the taxa.

3.8 MUSSELS

The data set MUSSEL95 (Table 3-14) contains presence/absence data on freshwater mussels found within each 75 meter sample segment during the summer index period. The

presence of mussels was observed at the time of electrofishing, by examining habitat within the stream segment. Mussels were identified to species.

Table 3-14. Contents of the data set MUSSEL95 containing freshwater mussel data

Variable	Type	Label/Common Name	Scientific Name
EDITDATE	Num	Date Last Revised	
SAMPDATE	Num	Date Sampled	
SITE	Char	Site	
ALEFLOAT	Num	ALEWIFE FLOATER	*Anodonta implicata*
ASIACLAM	Num	ASIATIC CLAM	*Corbicula fluminea*
CAROLANC	Num	CAROLINA LANCE	*Elliptio angustata*
EELLIPTI	Num	EASTERN ELLIPTIO	*Elliptio complanata*
EFLOATER	Num	EASTERN FLOATER	*Pyganodon*
MUSSEL	Num	MUSSEL (UNKNOWN)	
NLANCE	Num	NORTHERN LANCE	*Elliptio fisheriana*
YLANCE	Num	YELLOW LANCE	*Elliptio lanceolata*

3.8.1 Site Identifiers (SITE, EDITDATE, SAMPDATE)

The variable SITE identifies the sample segment at which the data were collected. Sample date (SAMPDATE) refers to the date that samples were collected. Edit date (EDITDATE) refers to the date when the data set was last revised. Both SAMPDATE and EDITDATE appear in the form MM/DD/YY, where MM is the month, DD the day, and YY the year (e.g., 03/31/94).

3.8.2 Mussel Taxa Presence

The names of mussel taxa observed are represented by a series of variables, each up to eight characters long (e.g., ASIACLAM for Asian clam; see Table 3-16). The value of each variable indicates the presence (1) or absence (0) of the taxa.

3.9 STREAM HABITAT ASSESSMENT

The HABIT95 data set (Table 3-15) includes information from stream habitat assessments conducted during the summer index period. Data were gathered through both field observation and direct measurement of habitat parameters. Habitat assessments were conducted on the same day as electrofishing, generally after completion of electrofishing passes. Habitat evaluations were conducted only by crew members approved by the MBSS Training Officer.

Table 3-15. Contents of the data set HABIT95 containing habitat assessment data

Variable	Type	Label
General Information		
SITE	Char	Site
EDITDATE	Num	Date Last Revised
SAMPDATE	Num	Date Sampled
A. Qualitative Habitat Assessment Parameters		
ADJ_COVR	Char	Adjacent Land Cover
AESTHET	Num	Aesthetic Rating
BANKSTAB	Num	Bank Stability
BUFF_TYP	Char	Buffer Type
CH_FLOW	Num	Channel Flow Status
CHAN_ALT	Num	Channel Alteration
EMBEDDED	Num	Embeddedness
EPI_SUB	Num	Epifaunal Substrate
INSTRHAB	Num	Instream Habitat
POOLQUAL	Num	Pool/Glide/Eddy Quality
REMOTE	Num	Remoteness
RIFFQUAL	Num	Riffle/Run Quality
RIP_WID	Num	Riparian Buffer Width (m)
SHADING	Num	Shading
VEL_DPTH	Num	Velocity/Depth Diversity

Table 3-15. Continued

Variable	Type	Label
B. Land Use		
COMM_IND	Char	Commercial/Industrial
CONI_FOR	Char	Coniferous Forest
CROPLAND	Char	Cropland
DEC_FOR	Char	Deciduous Forest
LANDFILL	Char	Landfill
OLD_FLD	Char	Old Field
ORCH_VIN	Char	Orchard/Vineyard/Nursery
PASTURE	Char	Pasture
RESIDENT	Char	Residential
SURFMINE	Char	Surface Mine
WETLAND	Char	Wetland
C. Stream Character		
BEAVPOND	Char	Beaver Pond
BEDROCK	Char	Bedrock
BOULDGT2	Char	Boulder > 2 m
BOULDLT2	Char	Boulder < 2 m
BRAIDED	Char	Braided
CHANNEL	Char	Channelized
COBBLE	Char	Cobble
CONCRETE	Char	Concrete/Gabion
DEEPPOOL	Char	Deep Pool $ .5 m
EFF_DIS	Char	Effluent Discharge
EMER_VEG	Char	Emergent Vegetation
FLOATVEG	Char	Floating Vegetation
GRAVEL	Char	Gravel

Table 3-15. Continued

Variable	Type	Label
H_REFUSE	Char	Human Refuse
MEANDER	Char	Meandering
NUMROOT	Num	No. of Rootwads
OH_COVER	Char	Overhead Cover
RIFFLE	Char	Riffle
ROOTWAD	Char	Rootwad
RUN_GLID	Char	Run/Glide
SAND	Char	Sand
SHALPOOL	Char	Shallow Pool < .5 m
SILTCLAY	Char	Silt/Clay
STORMDRN	Char	Storm Drain
STRAIGHT	Char	Straight
SUBM_VEG	Char	Submergent Vegetation
UNDCTBNK	Char	Undercut Bank
WOOD_DEB	Num	No. of Woody Debris
D. Physical Parameters		
DISCHARG	Num	Discharge (cfs)
DIS_METH	Char	Method Used to Calculate Discharge
FLOODHT	Num	Overbank Flood Ht (m)
MAXDEPTH	Num	Maximum Depth (cm)
SEG_LEN	Num	Segment Length (m)
ST_GRAD	Num	Stream Gradient (%)
THADEP0	Num	Thalweg Depth at 0 m (cm)
THADEP25	Num	Thalweg Depth at 25 m (cm)
THADEP50	Num	Thalweg Depth 50 m (cm)

Table 3-15. Continued

Variable	Type	Label
THADEP75	Num	Thalweg Depth at 75 m (cm)
THAVEL0	Num	Thalweg Velocity at 0 m (m/s)
THAVEL25	Num	Thalweg Velocity at 25 m (m/s)
THAVEL50	Num	Thalweg Velocity at 50 m (m/s)
THAVEL75	Num	Thalweg Velocity at 75 m (m/s)
WETWID0	Num	Wetted Width at 0 m (m)
WETWID25	Num	Wetted Width at 25 m (m)
WETWID50	Num	Wetted Width at 50 m (m)
WETWID75	Num	Wetted Width at 75 m (m)
E. Stream Blockages		
ST_BLKHT	Num	Stream Block Ht (m)
ST_BLKTP	Char	Stream Block Type

3.9.1 General Information in the Habitat Data Set

3.9.1.1 Site Identifiers (SITE, EDITDATE, SAMPDATE)

The variable SITE identifies the sample segment at which the data were collected. Sample date (SAMPDATE) refers to the date that samples were collected. Edit date (EDITDATE) refers to the date when the data set was last revised. Both SAMPDATE and EDITDATE appear in the form MM/DD/YY, where MM is the month, DD the day, and YY the year (e.g., 03/31/94).

3.9.2 Qualitative Habitat Assessment Parameters

3.9.2.1 Habitat Assessment Scores or Percentages

Following the MBSS Habitat Assessment Guidance Sheet (Table 2-5), scores or percentages were assigned for each of 13 parameters describing the instream habitat, riparian buffer, and general site surroundings (Table 3-15A). For most parameters, assessment was based on observation of the entire 75 m segment and adjacent riparian buffer. Aesthetic rating and remoteness values described the general vicinity of the sample segment.

3.9.2.2 Riparian width, buffer type, and adjacent land cover (RIP_WID, BUFF_TYP, ADJ_COVR)

The width of the vegetated riparian buffer (RIP_WID) was measured in meters, to a maximum of 50 m. If the buffer was greater than or equal to 50 m, a value of 50 was entered. This measure is the width of the vegetated riparian buffer on the side of the stream with the smallest buffer. The dominant type of riparian buffer (BUFF_TYP) and the dominant type of land cover adjacent to the buffer (ADJ_COVR) are described by one of 16 land cover codes (Table 3-16).

Table 3-16. Entries for Riparian Buffer Zone type (BUFF_TYP) and Adjacent Land Cover type (ADJ_COVR) in the HABITAT data set

Land Cover Type	Code
Forest	FR
Old Field	OF
Emergent Vegetation	EM
Mowed Lawn	LN
Tall Grass	TG
Logged Area	LO
Bare Soil	SL
Railroad	RR
Paved Road	PV
Parking Lot/Industrial/Commercial	PK
Gravel Road	GR
Dirt Road	DI
Pasture	PA
Orchard	OR
Cropland	CP
Housing	HO

3.9.3 Land Use

3.9.3.1 Land Use Categories

Land use immediately visible from the sample segment was characterized by recording one or more land use types observed. All applicable categories were noted, from a list of 11 standard categories (Table 3-15B). In the HABIT95 data set, each land use category is listed as a separate variable. An entry of "X" denotes the presence of a given land use in the area immediately visible from the sample segment.

3.9.4 Stream Character

3.9.4.1 Stream Character Categories

Stream characteristics within the 75-meter sampling segment were described by recording characters present from a list of 26 standard categories (Table 3-15C). Features considered functionally important within the segment were included. In the HABIT95 data set, each stream character feature is listed as a separate variable, with an entry of "X" indicating the presence of that stream character feature.

3.9.4.2 Woody Debris (WOOD_DEB) and Number of Rootwads (NUMROOT)

The number of pieces of woody debris (WOOD_DEB) in the 75-meter segment was recorded. In 1995, the number of rootwads (NUMROOT) in the segment was also recorded.

3.9.5 Physical Parameters

Physical measures are found in Table 3-15D.

3.9.5.1 Maximum Depth (MAX DEPTH)

Maximum stream depth (MAXDEPTH) within the 75-meter segment is given in centimeters.

3.9.5.2 Wetted Width (WETWID0, WETWID25, WETWID50, WETWID75)

The wetted width of the stream, in meters, was measured at the 0, 25, 50, and 75 m points of the sample segment, where 0 m was the downstream end of the segment. These width measures are represented by the variables WETWID0, WETWID25, WETWID50, and

WETWID 75. Wetted width was measured perpendicular to the direction of streamflow by stretching a meter tape across the entire distance in which water was found.

3.9.5.3 Thalweg Depth (THADEP0, THADEP25, THADEP50, THADEP75)

Thalweg depth, the deepest portion of the lateral transect, was measured at the 0, 25, 50, and 75 m points of the sample segment. Thalweg depths, in centimeters, are represented by the variables THADEP0, THADEP25, THADEP50, AND THADEP75.

3.9.5.4 Thalweg Velocity (THAVELO, THAVEL25, THAVEL50, THAVEL75)

Thalweg velocity was measured with a flowmeter at the deepest portion of the lateral transect at the 0, 25, 50, and 75 m points of the sample segment. Thalweg velocity, in meters per second, is represented by the variables THAVELO, THAVEL25, THAVEL50, AND THAVEL75.

3.9.5.5 Overbank Flood Height (FLOODHT)

Overbank flood height (FLOODHT) was estimated by measuring the height in meters of any wrack found above the lower bank of the stream. If no evidence of overbank flows was found, a "0" was entered.

3.9.5.6 Straight Line Segment Length (SEG_LEN)

A rangefinder or measuring tape was used to obtain the straight-line distance, in meters, between the 0 and 75 m points of the sample segment. This straight line segment length (SEG_LEN) may be used to calculate sinuosity.

3.9.5.7 Stream Gradient (ST_GRAD)

Stream gradient was measured from the downstream boundary (0 meter point) to the upstream boundary of a segment (75 m point) using an inclinometer to measure the water surface slope. Stream gradient (ST_GRAD) is given as percent slope.

3.9.5.8 Discharge (DISCHARG) and Method of Measurement (DIS_METH)

Discharge (streamflow), represented by the variable DISCHARG, is reported in the data set in units of cubic feet per second (cfs). Discharge was calculated from raw data collected at each stream segment from a site visit during the summer sampling period.

At most sites, a standard transect method was employed. The field crew constructed a velocity/depth provide of the segment using a current meter to measure stream velocity and recording stream depth at 10 to 20 regular intervals across the stream. At each location along the transect, velocity was measured at a point 0.6 of the distance from the water surface to the bottom. Calculation of discharge from raw velocity, depth, and lateral location data followed standard procedures as described by Buchanan and Somers (undated).

At other sites, where flows were too low to be measured with a current meter, an alternative method was used. Flow was constricted as much as possible in a 1 meter section of uniform width, and the speed of a floated object was determined. The depth, width, and time (three trials) for a floated object to move 1 m were recorded and used to calculate discharge.

The variable DIS_METH indicates the method that was used to measure stream discharge. The standard transect method is designated as type TRAN and the alternative method, using a floated object, is designated as type ALT. A third type, NOFLOW, describes stream sites with no measurable flow.

3.9.6 Stream Blockages

3.9.6.1 Stream Blockage Type and Height (ST_BLKTP, ST_BLKHT)

The presence of any human-constructed instream blockages greater than 0.3 m in height was noted (Table 3-15E). Any such blockages in or near the sampling segment were included. The type of instream blockage (ST_BLKTP) is given as one of 9 categories (Table 3-17). The height of the instream blockage (ST_BLKHT) was measured in meters from stream surface to water surface above structure.

3.10 ADDITIONAL BIOLOGICAL SAMPLING INFORMATION

During spring and summer sampling, additional information regarding biological sampling methods, site characteristics, and *in situ* water quality was recorded. This additional information is compiled here in two data sets, SPRIND95 and SUMIND95.

3.10.1 Spring Index Period

Additional biological sampling information in the SPRIND95 data set (Table 3-18) was collected during the spring index period, 1 March to 1 May. This data set describes the types of benthic habitat sampled for macroinvertebrates. In 1995, the presence, size, and sampleability of culverts found within sample segments is documented here.

Table 3-17. Types of instream blockages observed. Entries for the variable ST_BLKTP in the HABIT95 data set.

Instream Blockage Type	Code
Arch Culvert	AC
Box Culvert	BC
Dam	DM
Fishway	F
Gabion	G
Gaging Station Weir	GW
Pipe Culvert	PC
Pipeline Crossing	PX
Tide Gate	TG

Table 3-18. Contents of the data set SPRIND95 containing additional biological sampling information for the spring index period

Variable	Type	Label
CULVPRES	Char	Culvert Present? (Y/N)
CULVSAMP	Char	Culvert Sampleable (Y/N)
CULVWID	Num	Culvert Width (m)
EDITDATE	Num	Date Last Revised
MACROPHY	Num	Macrophytes (sq. ft.)
OTH_BEN	Num	Other Benthic Habitat (sq. ft.)
RIFFLE	Num	Riffle (sq. ft.)
RW_WD_LP	Num	Rootwad/Woody Debris/Leaf Pack (sq. ft.)
SAMPDATE	Num	Date Sampled
SITE	Char	Site
TIME	Num	Time
UND_BNK	Num	Undercut Banks (sq. ft.)

3.10.1.1 Site Identifiers (SITE, EDITDATE, SAMPDATE)

The variable SITE identifies the sample segment at which the data were collected. Sample date (SAMPDATE) refers to the date that samples were collected. Edit date (EDITDATE) refers to the date when the data set was last revised. Both SAMPDATE and EDITDATE appear in the form MM/DD/YY, where MM is the month, DD the day, and YY the year (e.g., 03/31/94).

3.10.1.2 Benthic Habitat Sampled

Benthic macroinvertebrates were sampled within a variety of instream habitats likely to support the greatest taxonomic diversity. Riffle areas (RIFFLE) were preferred; other sampled habitats included rootwad/woody debris/leaf pack (RW_WD_LP), macrophytes (MACROPHY), undercut banks (UND_BNK), and other benthic habitats (OTH_BEN). The area, in square feet, sampled in each of these benthic habitat types is given under these five variables. A total of 1.8 m^2 (20 square feet) of combined substrates was sampled at each site.

3.10.1.3 Time (TIME)

In the SPRIND95 data set, the variable TIME represents the time that spring sampling was conducted. Time appears in military units in the form HH:MM, where HH is the hour and MM the minutes (example: 13:05 is 1:05 p.m. Eastern time).

3.10.1.4 Presence, Sampleability, and Size of Culverts (CULVPRES, CULVSAMP, CULVWID)

Culvert presence (CULVPRES) indicates whether or not a culvert was located within the 75 m sample segment. Culvert presence is indicated by a yes (Y) or no (N). If present, culvert sampleability (CULVSAMP) was evaluated. Large culverts were able to be electrofished in some cases. Culvert sampleability is indicated by a yes (Y) or no (N). For sites with a culvert, culvert width (CULVWID) was measured in meters.

3.10.2 Summer Index Period

Additional biological sampling information in the SUMIND95 data set (Table 3-19) was collected during the summer index period, 1 June to 30 September. This includes information on water quality, electrofishing gear, fish movement and water clarity. For 1995, this data set also includes the number of gamefish not measured.

Table 3-19. Contents of the data set SUMIND95 containing additional biological sampling information for the summer index period

Variable	Type	Label
ANODES1	Num	No. Anodes Used - Unit 1
ANODES2	Num	No. Anodes Used - Unit 2
ANODES3	Num	No. Anodes Used - Unit 3
ANODES4	Num	No. Anodes Used - Unit 4
BEG1P_1	Num	Begin 1st Pass - Unit 1
BEG1P_2	Num	Begin 1st Pass - Unit 2
BEG1P_3	Num	Begin 1st Pass - Unit 3
BEG1P_4	Num	Begin 1st Pass - Unit 4
BEG2P_1	Num	Begin 2nd Pass - Unit 1
BEG2P_2	Num	Begin 2nd Pass - Unit 2
BEG2P_3	Num	Begin 2nd Pass - Unit 3
BEG2P_4	Num	Begin 2nd Pass - Unit 4
BOT_SEEN	Char	Bottom Seen in All Areas (Y/N)
COND_FLD	Num	In-situ Conductivity (μmho/cm)
DO	Num	DO (ppm)
EDITDATE	Num	Date Last Revised
END2P_1	Num	End 2nd Pass - Unit 1
END2P_2	Num	End 2nd Pass - Unit 2
END2P_3	Num	End 2nd Pass - Unit 3
END2P_4	Num	End 2nd Pass - Unit 4
FISHCAPT	Char	Fish Captured (Y/N)
FISH_MOV	Char	Fish Movement (Y/N)
HZ	Num	Electroshock Hz
NG_WT1	Num	Total Non-game Weight (g), Pass 1
NG_WT2	Num	Total Non-game Weight (g), Pass 2

Table 3-19. Continued

Variable	Type	Label
NOTMEAS1	Num	No. Gamefish Not Measured - Pass 1
NOTMEAS2	Num	No. Gamefish Not Measured - Pass 2
PH_FLD	Num	In-situ pH
SAMEWQ_2	Char	Same Water Qual. in pass 2 (Y/N)
SAMPDATE	Num	Date Sampled
SAMP_LEN	Num	Segment Length Sampled (m)
SITE	Char	Site
TEMP	Num	Temperature (C)
TGAM_WT1	Num	Total Gamefish Weight (g), Pass 1
TGAM_WT2	Num	Total Gamefish Weight (g), Pass 2
TIME	Num	Time
VOLTAGE	Num	Electroshock Voltage

3.10.2.1 Site Identifiers (SITE, EDITDATE, SAMPDATE)

The variable SITE identifies the sample segment at which the data were collected. Sample date (SAMPDATE) refers to the date that samples were collected. Edit date (EDITDATE) refers to the date when the data set was last revised. Both SAMPDATE and EDITDATE appear in the form MM/DD/YY, where MM is the month, DD the day, and YY the year (e.g., 03/31/94).

3.10.2.2 Field Water Quality Parameters

Field water chemistry data from summer index period sampling are included here in the SUMIND95 data set. pH, conductivity, dissolved oxygen, and temperature were measured during summer sampling.

Note: Water chemistry data from laboratory analysis of spring index period samples are found in the WCHEM95 data set. These include pH (PH_LAB), ANC (ANC), sulfate (SO4), nitrate (NO3), conductivity (COND_LAB), and DOC (DOC).

pH (PH_FLD). The summer pH is given in standard pH units.

Conductivity (COND_FLD). *In situ* conductivity is given in ：mho/cm.

Dissolved Oxygen (DO). DO concentration is given in parts per million (ppm).

Temperature (TEMP). Temperature is given in Celsius degrees.

3.10.2.3 Aggregate Weights (TGAM_WT1, TGAM_WT2, NG_WT1, NG_WT2)

Also included are the aggregate (total) wet weights of gamefish (TGAM_WT1, TGAM_WT2) and non-game species (NG_WT1, NG_WT2) collected in each pass.

3.10.2.4 Electrofishing Gear (HZ, VOLTAGE, ANODES1 to ANODES4, BEG1P_1 to BEG1P_4, BEG2P_1 to BEG2P_4, END2P_1 to END2P_4)

Frequency in hertz (HZ) and output voltage (VOLTAGE) settings for the backpack electrofishing unit were recorded. Output voltage was adjusted according to stream conductivity. The number of anodes used with each electrofishing unit are represented by the variables ANODES1 (for unit 1) through ANODES4 (for unit 4).

Timer readings on each electrofishing unit were recorded at the beginning and end of each pass. Readings at the beginning of the first pass are represented by the variables BEG1P_1 (for unit 1) through BEG1P_4 (for unit 4). Readings at the beginning of the second pass are given as BEG2P_1 through BEG2P_4. Readings at the end of the second pass are given as END2P_1 through END2P_4.

3.10.2.5 Fish Movement and Water Clarity (FISH_MOV, BOT_SEEN, SAMEWQ_2)

Field crews noted fish movement to or from the boundaries of the sampling segment during setup of the blocking nets. Fish movement (FISH_MOV) is indicated by a yes (Y) or no (N).

Crews noted whether or not the stream bottom was clearly visible in all portions of the segment. Whether the bottom was seen in all areas (BOT_SEEN) is indicated by a yes (Y) or no (N).

Water clarity during the second electrofishing pass was compared with initial water clarity. Same water clarity in pass 2 (SAMEWQ_2) is specified by a yes (Y) or no (N).

3.10.2.6 Fish Captured (FISHCAPT)

The variable FISHCAPT indicates whether any fish were captured with a yes (Y) or no (N). This represents combined gamefish and non-game fish species for both passes.

3.10.2.7 Number of Fish Not Measured (NOTMEAS1, NOTMEAS2)

Length measures of gamefish were taken for 50 individuals of each species. When a large number of gamefish were captured, additional fish from each pass were not measured. The number of individual gamefish not measured in each pass was recorded as 1st pass number not measured (NOTMEAS1) and 2nd Pass number not measured (NOTMEAS2).

3.10.2.8 Segment Length Actually Sampled (SAMP_LEN)

The length of the segment that was actually sampled by electrofishing is given in meters.

3.10.2.9 Time (TIME)

In the SUMIND95 data set, the variable TIME represents the time that summer sampling was conducted. Time appears in military units in the form HH:MM, where HH is the hour and MM the minutes (example: 13:05 is 1:05 p.m. Eastern time).

4 GUIDELINES FOR DATA ANALYSIS

4.1 ESTIMATING MEANS, TOTALS, AND PROPORTIONS

Estimation of summary statistics for each stream order in a basin is straightforward since all sites (SITETYPE 1 and 2) are randomly selected within each stream order. Estimation across stream order must take into account the stratified random sampling. Estimates are first calculated by stream order, and then combined by an appropriate weighting. The weights for each order is the fraction of stream miles in that order. Cochran (1977) provides estimators for means, proportions and totals, and their variances for random and stratified random sampling. Additional information on the appropriate statistical methods for analyzing MBSS 1995 data can be found in Roth et al. (1997b).

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APPENDIX A

SAMPLE FIELD DATA SHEETS FOR THE 1995 MBSS

MBSS SPRING INDEX PERIOD DATA SHEET

Page ____ of ____

SAMPLE SEGMENT County ____ Region ____ Reach ID ____ Segment ____ Reviewed By: _____

BASIN ____ (see back for codes) **CREW** _____ 2nd Reviewer: _____

DATE Y Y ____ M M ____ D D ____ **STREAM** _____

TIME (Military) ____ **COMMENTS** _____

SAMPLEABILITY

Can segment be sampled? (Y/N) ____

If no, for what reasons? ____

1 = Dry Streambed
2 = Too Deep
3 = Marsh, no defined channel
4 = Excessive Riparian Vegetation
5 = Impoundment
6 = Tidally Influenced
7 = Permission Denied
8 = Unsafe (describe in comments)
9 = Other

PHOTODOCUMENTATION

(Optional if Sampleable)

Roll #/Frame # ____ Title _____

____ _____

____ _____

____

ROAD CULVERT

Present in Segment? (Y/N) ____

Sampleable? (Y/N) ____

Width of Culvert (m) ____

SITE ACCESS ROUTE: _____

Bottle Label Verified by: _____

Syringe Label Verified by: _____

QC LABEL

County ____ Region ____ Reach ID ____ Segment ____

Bottle label verified by: _____

Syringe label verified by: _____

Benthos label verified by: _____

Duplicate(D) or Blank(B): ____

BENTHIC HABITAT SAMPLED

(Square feet; Total = 20 square feet)

____ Riffle

____ Rootwad/Woody Debris/Leak Pack

____ Macrophytes

____ Undercut Banks

____ Other (specify)

STREAM WIDTH (m) 0 m ____ 75 m ____

MBSS Drainage Basin Codes

YG = Youghiogheny River
NO = North Branch Potomac River
UP = Upper Potomac River
MP = Middle Potomac River
CO = Conawago Creek
PW = Potomac Washington Metro

LP = Lower Potomac River
PX = Patuxent River
WC = West Chesapeake
PP = Patapsco River
BU = Bush River
GU = Gunpowder River

SQ = Lower Susquehanna River
EL = Elk River
CR = Chester River
CK = Choptank River
NW = Nanticoke-Wicomico Rivers
PC = Pocomoke River
OC = Ocean Coastal

MBSS NON-GAME FISH DATA SHEET

Page ___ of ___

SAMPLE SEGMENT County ___ - Region ___ - Reach ID ___ - Segment ___

Reviewed By: ___________

DATE Y Y ___ M M ___ D D ___

2nd Reviewer: ___________

Fish Movement During Net Installation? (Y/N) ___

Can Bottom be Seen in all Areas of Segment? (Y/N) ___

Same Water Clarity on 2nd Pass? (Y/N) ___

Voltage ______ Hz ______

Length of Segment Actually Sampled (m) ___

	Unit 1	Unit 2	Unit 3
Anodes/Unit			
Time (sec) Begin 1st pass			
Time (sec) Begin 2nd pass			
Time (sec) End 2nd pass			

Fish Captured? (Y/N) ___

NON-GAME SPECIES (Append A for Name Spelling)	Re-tained? (Y/N)	1st Pass Catch (Total)	2nd Pass Catch (Total)	# Exam for Anom (100 max)	Type & # of Anomalies (see back of Habitat Data Sheet) No.	Type	No.	Type

Aggreg Non-Game Fish Biomass ______ | ______ **(g)**

MBSS GAME FISH DATA SHEET

Page ____ of ____

SAMPLE SEGMENT — County | Region | Reach ID | Segment

Reviewed By: _____

2nd Reviewer: _____

DATE — Y Y | M M | D D

1ST Pass Gamefish

____ Pass Gamefish

	SPECIES	LENGTH (TL; mm)	ANOM TYPE	SPECIES	LENGTH (TL; mm)	ANOM TYPE
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						
19.						
20.						
21.						
22.						
23.						
24.						
25.						
26.						
27.						
28.						
29.						
30.						

Aggregate Gamefish Biomass (g) _____

2ND PASS Aggreg Game Biomass _____

MBSS SUMMER INDEX PERIOD DATA SHEET

Page ____ of ____

SAMPLE SEGMENT County ____ Region ____ Reach ID ____ Segment ____

Reviewed By: _____

BASIN ____ (see back for codes) **CREW** _____

2nd Reviewer: _____

DATE Y Y ____ M M ____ D D ____ **STREAM** _____

TIME (Military) ____ **COMMENTS** _____

Can segment be sampled? (Y/N) ____

If no, for what reasons? ____

1 = Dry Streambed
2 = Too Deep
3 = Marsh, no defined channel
4 = Excessive Riparian Vegetation
5 = Impoundment
6 = Tidally Influenced
7 = Permission Denied
8 = Unsafe (describe in comments)
9 = Other

HERPETOFAUNA

Taxa Observed	Retained? (Y/N)

AQUATIC PLANTS

Taxa Observed	Retained? (Y/N)

MUSSELS

Taxa Observed	Retained? (Y/N)

WATER QUALITY

Temp (C) ____ DO (ppm) ____ pH ____ Cond (umho/cm) ____ Turbidity (NTU) ____

Meter Calibration Date _____ by: _____

MBSS Drainage Basin Codes

YG = Youghiogheny River
NO = North Branch Potomac River
UP = Upper Potomac River
MP = Middle Potomac River
CO = Conawago Creek
PW = Potomac Washington Metro

LP = Lower Potomac River
PX = Patuxent River
WC = West Chesapeake
PP = Patapsco River
BU = Bush River
GU = Gunpowder River

SQ = Lower Susquehanna River
EL = Elk River
CR = Chester River
CK = Choptank River
NW = Nanticoke-Wicomico Rivers
PC = Pocomoke River
OC = Ocean Coastal

MBSS GAME FISH DATA SHEET (continued)

Page ____ of ____

SAMPLE SEGMENT County ____ Region ____ Reach ID ____ Segment ____

Reviewed By: _____

DATE Y Y M M D D

2nd Reviewer: _____

___ Pass Gamefish

	SPECIES	LENGTH (TL; mm)	ANOM TYPE
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
21.			
22.			
23.			
24.			
25.			
26.			
27.			
28.			
29.			
30.			

1ST PASS NUMBER NOT MEASURED ____

___ Pass Gamefish

SPECIES	LENGTH (TL; mm)	ANOM TYPE

2ND PASS NUMBER NOT MEASURED ____

MBSS STREAM HABITAT ASSESSMENT DATA SHEET

Page ___ of ___

SAMPLE SEGMENT County ___ - Region ___ - Reach ID ___ - Segment ___

Reviewed by: ___

2nd Reviewer: ___

BASIN ___ (see back for codes)

DATE Year ___ Month ___ Day ___

CREW: ___

TIME ___ (Military)

STREAM:

LANDUSE

- ☐ Old Field
- ☐ Deciduous Forest
- ☐ Coniferous Forest
- ☐ Wetland
- ☐ Surface Mine
- ☐ Landfill
- ☐ Residential
- ☐ Commercial/Industrial
- ☐ Cropland
- ☐ Pasture
- ☐ Orchard/Vineyard/Nursery

STREAM CHARACTER

- ☐ Meandering
- ☐ Braided
- ☐ Channelized
- ☐ Straight
- ☐ Riffle
- ☐ Run/Glide
- ☐ Deep Pool >=.5m
- ☐ Shallow Pool ,.5m
- ☐ Boulder>2m
- ☐ Boulder <2m
- ☐ Cobble
- ☐ Bedrock
- ☐ Gravel
- ☐ Sand
- ☐ Silt/Clay
- ☐ Concrete/Gabion
- ☐ Rootwad
- ☐ Undercut Bank
- ☐ Overhead Cover
- ☐ Human Refuse
- ☐ Emergent Vegetation
- ☐ Submergent Vegetation
- ☐ Floating Vegetation
- ☐ Storm Drain
- ☐ Effluent Discharge
- ☐ Beaver Pond

☐ No. of Woody Debris

☐ No. of Rootwads

HABITAT ASSESSMENT

1. **Instream Habitat (0-20)**..............
2. **Epifaunal Substrate (0-20)**..........
3. **Velocity/Depth Diversity (0-20)**....
4. **Pool/Glide/Eddy Quality (0-20)**....
5. **Riffle/Run Quality (0-20)**............
6. **Channel Alteration (0-20)**...........
7. **Bank Stability (0-20)**.................
8. **Embeddedness (%)**...............
9. **Channel Flow Status (%)**.......
10. **Shading (%)**.......................
11. **Riparian Buffer Zone Width (m)**....
    - **Buffer Type (see back)**............
    - **Adjacent Land Cover (see back)**.
12. **Remoteness (0-20)**..................
13. **Aesthetic Rating (0-20)**............

Maximum Depth (cm) ___

	Wetted Width (m)	Thalweg Depth (cm)	Thalweg Velocity (m/s)
0m			
25m			
50m			
75m			

Overbank Flood Height (m) ___

FLOW

Lat Loc(m)	Depth(cm)	Velocity (m/s)

Alternative Flow Measurements

Distance (1m)

Depth (cm) ___

Width (cm) ___

Time (sec) 1. ___ 2. ___ 3. ___

Stream Gradient (%) ___

Straight Line Segment Length (m) ___

Stream Block Ht. (m) ___

Stream Block Type ___

Lat ___ deg ___ min ___ sec

Lon ___

COMMENTS ___

Riparian Buffer Zone/
Adjacent Land Cover Types

FR = Forest
OF = Old Field
EM = Emergent Vegetation
LN = Mowed Lawn
TG = Tall Grass
LO = Logged Area

SL = Bare Soil
RR = Railroad
PV = Paved Road
PK = Parking Lot/Industrial/Commerical
GR = Gravel Road
DI = Dirt Road
PA = Pasture
OR = Orchard
CP = Cropland
HO = Housing

ANOMALLY TYPES (for Summer Index Period Data Set)

Body Surfaces and Fins

DI = Discoloration
HM = Hemorrhaging
CL = Fin Cloudiness
RS = Raised Scales
BL = Black Spot
EP = Visible External Parasites
GR - Growths/Cysts
UL = Ulcerations/Lesions
FI = Fin Erosion
DV = Deformities of the Vertebral Column
DM = Deformities of the Mandible
AN = Swelling of the Anus
SC = Scale Deformities
RE = Red Spot
HK = Hooking Injury
OT = Other (define in comments section)

BS = Body Shape
FD = Fin deformed or missing
CT = Cut
IK = Ich
AW = Anchor Worm
LE = Leeches

Eyes

EC = Eye Cloudiness
EH = Eye Hemorrhage
PO = Exopthalmia (pop eye)
OR = Depression into the Orbits
NO = Eye Missing
CA = Cataract

INSTREAM BLOCKAGE CODES

DM = Dam
PC = Pipe Culvert
F = Fishway
GW = Gaging Station Weir
G = Gabion
PX = Pipeline Crossing
AC = Arch Culvert
BC = Box Culvert
TG = Tide Gate

MBSS Drainage Basin Codes

YG = Youghiogheny River
NO = North Branch Potomac River
UP = Upper Potomac River
MP = Middle Potomac River
CO = Conawago Creek
PW = Potomac Washington Metro

LP = Lower Potomac River
PX = Patuxent River
WC = West Chesapeake
PP = Patapsco River
BU = Bush River
GU = Gunpowder River

SQ = Lower Susquehanna River
EL = Elk River
CR = Chester River
CK = Choptank River
NW = Nanticoke-Wicomico Rivers
PC = Pocomoke River
OC = Ocean Coastal

(Note: Height is measured in meters from stream surface to water surface above structure)

APPENDIX B

CHANGES IN VARIABLES USED IN

1994 AND 1995 MBSS DATA SETS

I. Variables used in 1994; not used in 1995

SITES94 data set:

Watershed (WATSHED)

SPRIND94 data set:

Other Benthic Description (OTH_DESC)

SUMIND94 data set:

Begin 1st Pass (BEG_1)
Begin 2nd Pass (BEG_2)
End 2nd Pass (END_2)

TRAFLO94 data set: replaced by the variable DISCHARG in 1995

ALTFLO94 data set: replaced by the variable DISCHARG in 1995

II. Variables not used in 1994; used in 1995

SITES95 data set:

Site Type, Based on Study Design (SITETYPE)
Reason For Not Sampling in Spring (YNOTSPR)
Reason For Not Sampling in Summer (YNOTSUM)

MUSSEL95 data set (entire data set new in 1995)

HABIT95 data set:

Number of Rootwads (NUMROOT)
Thalweg Velocity at 0 m (THAVELO)
Thalweg Velocity at 25 m (THAVEL25)
Thalweg Velocity at 50 m (THAVEL50)
Thalweg Velocity at 75 m (THAVEL75)
Discharge (DISCHARG)

SPRIND95 data set:

Culvert Presence (CULVPRES)
Culvert Sampleability (CULVSAMP)
Culvert Width (CULVWID)

SUMIND95 data set:

Number of Anodes--Unit 1 (ANODES1)
Number of Anodes--Unit 2 (ANODES2)
Number of Anodes--Unit 3 (ANODES3)
Number of Anodes--Unit 4 (ANODES4)
Begin 1st Pass--Unit 1 (BEG1P_1)
Begin 1st Pass--Unit 2 (BEG1P_2)
Begin 1st Pass--Unit 3 (BEG1P_3)
Begin 1st Pass--Unit 4 (BEG1P_4)
Begin 2nd Pass--Unit 1 (BEG2P_1)
Begin 2nd Pass--Unit 2 (BEG2P_2)
Begin 2nd Pass--Unit 3 (BEG2P_3)
Begin 2nd Pass--Unit 4 (BEG2P_4)
End 2nd Pass--Unit 1 (END2P_1)
End 2nd Pass--Unit 2 (END2P_2)
End 2nd Pass--Unit 3 (END2P_3)
End 2nd Pass--Unit 4 (END2P_4)
Fish Captured (FISHCAPT)
1st Pass Number Not Measured (NOTMEAS1)
2nd Pass Number Not Measured (NOTMEAS2)

III. Other Changes

GAMLEN94 and NGANOM94 data sets:

Redfin pickerel was recorded as a gamefish species in 1994

GAMLEN95 and NGANOM95 data sets:

Redfin pickerel was recorded as a nongame fish species in 1995